

Pediatric Radiology

By

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Chest X-Ray

Comment

- Plain CXR
- Postero-anterior view
- The patient is more or less centralized (Or not well centralized)?? Clavicles
- Normal bony cage
- Normal situs (Gastric air bubble on the left side)
- Costophrenic angles are free bilaterally
- Normal C/T ratio [Normally = 55%]
- Lung fields: e.g., consolidation, collapse, exaggerated BVMs...
- Central mediastinum

Mediastinum

- **Trachea:** Normally central or slightly to the Right side
- **Cardiac shadow:** In the middle with 2/3 to the Left & 1/3 to the Right

- Look if there is...
- Look if there is...

Lesions in CXR

A) Partial unilateral Opacity

- Consolidation
- Collapse
- Effusion

B) Opaque hemithorax

- Massive Consolidation
- Massive Collapse
- Massive Effusion
- Mass

C) Hypertranslucency

- Pneumothorax
- Emphysema

D) Air-Fluid level

- Hydropneumothorax
- Lung abscess

E) Hypertranslucencies with opacities

- Congenital diaphragmatic hernia
- Pneumonia with Pneumatocoles

Unilateral Opacity

	Collapse	Effusion	Consolidation
Site	Upper lobe*	Lower part (C/P angle)	Any
Type of opacity	Homogenous Well-demarcated	Homogenous	Heterogenous or Homogenous
Border	Triangular Outer concave border	Rising to the axilla	Not well-defined
Mediastinal Shift	To the SAME side	To the OPPOSITE side	No Shift

Hypertranslucency

a. Pneumothorax:

- Jet-black translucency with No BVM
- Copula of the diaphragm is shifted downwards
- Wide spacing of the ribs (on the same side)

b. Emphysema:

- Compensatory emphysema: With other lesions (e.g., collapse, consolidation...)
- Surgical emphysema: Hypertranslucency between the chest wall & the skin

Air-Fluid Level

	Hydropneumothorax	Lung Abscess
Air-fluid level	The whole hemithorax	Part of the hemithorax
C/P angle	Obliterated	Free
Mediastinal Shift	To the OPPOSITE side	No Mediastinal Shift
Lung tissue above	No	Yes

Hypertranslucencies with opacities

a. Congenital diaphragmatic hernia

- Multiple radiolucent areas simulating pneumatoceles communicating with abdominal air and intermingled with heterogenous opacities simulating pneumonic consolidation
- Non-visualized diaphragmatic copula
- Shift of the mediastinum to the OPPOSITE side

b. Pneumonia with Pneumatocoles

- Pneumatocoles: Hypertranslucent
- Pneumonia: Opacities
- Not communicating with abdominal air
- Intact diaphragmatic copula
- No mediastinal shift

Abdominal X-Ray

Comment

- Plain erect X-ray of the abdomen & chest
- X-ray abdomen with contrast
 - Barium meal: CHPS
 - Barium enema: Intussusception
 - Barium meal & follow-through: Congenital diaphragmatic hernia

Without contrast	With contrast
Intestinal obstruction	Intussusception
Pneumoperitoneum	CHPS
Duodenal atresia	Congenital Diaphragmatic hernia

Intestinal Obstruction

- Abdominal distension
- Lower part of the abdomen is devoid of gases (gasless)
- Multiple air-fluid levels

Pneumoperitoneum

- Abdominal distension
- Free air (Hypertranslucency) under the diaphragm along both copulae
- Abdominal viscera are pushed centrally
- Picture of pneumoperitoneum (Perforated viscus)

Duodenal Atresia

- 2 air-fluid levels
- Double bubble sign (Fluid in the stomach & duodenum)
- No gas distal to the obstruction
- No marked abdominal distension

Intussusception

- Sudden stoppage of the contrast at the area of the transverse colon
- Characteristic claw sign due to passage of the contrast between the intussusceptum & the intussusceptient OR
- Characteristic coiled-spring sign

CHPS

- Marked dilatation of the stomach
- Narrow pyloric canal "String sign"
- Umbrella-shaped duodenal cap
- Delayed gastric emptying (Correlate with time!!)

Diaphragmatic hernia!!

- Herniated barium filled intestinal loops into the Rt or Lt hemithorax
- The mediastinum [Tracheal air column & Heart] is shifted to the opposite side

Cardiac X-Ray

A. Special Configuration

- Boot-shaped heart (Coer en sabot)
- Egg-shaped heart
- Flask-shaped cardiac shadow

B. Cardiomegaly without special configuration

- Mention C/T ratio
- Mention Chamber enlargement
- Comment on Lung fields: ↑↑ BVMs

C. Pneumopericardium

- Area of jet black translucency surrounding the cardiac shadow (air in the pericardial sac)

D. Abnormal situs

- Isolated dextrocardia
- Situs inversus totalis

Bone X-Ray

A) Rickets

	Active Rickets
Metaphysis	Broadening Cupping Fraying
Diaphysis	↓↓ Bone density Deformities & Fractures (Green-stick) Double periosteal line
Epiphysis	↑↑ Joint space Bone age (Carpal bones)



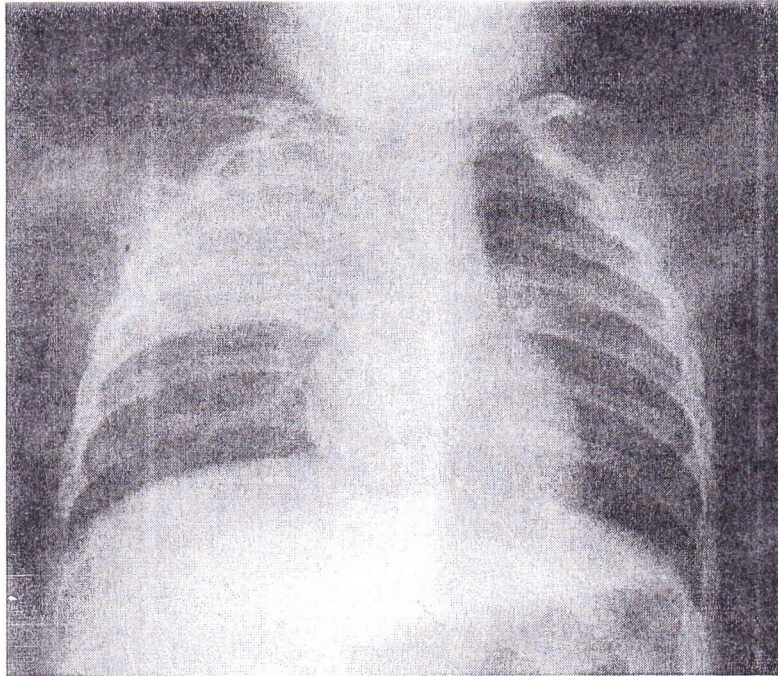
B) Mucopolysaccharidosis (=Dysostosis Multiplex)

- Skull: Macrocephaly, Dolicocephaly, J-shaped sella turcica
- Clavicles: Thickening of the medial 1/3
- Ribs: Spatulated (oar-shaped)
- Vertebrae: Ovoid with anterior beaking
- Iliac bones: Flaring
- Radius & Ulna: Abnormal with V-shaped articulation
- Metacarpals: Pointed proximally (5th*)
- Phalanges: Pointed distally (bullet-shaped)

C) Achondroplasia

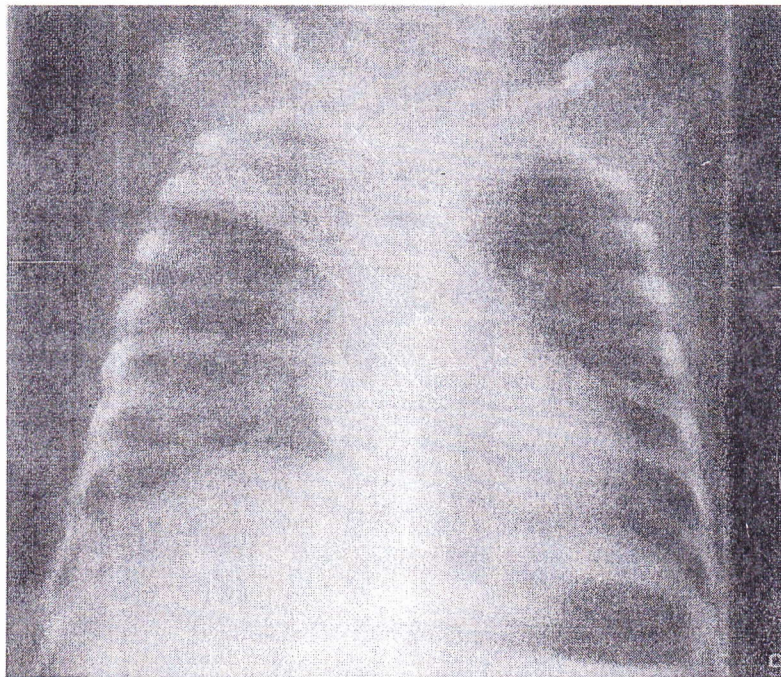
D) Osteogenesis imperfecta

E) Osteopetrosis



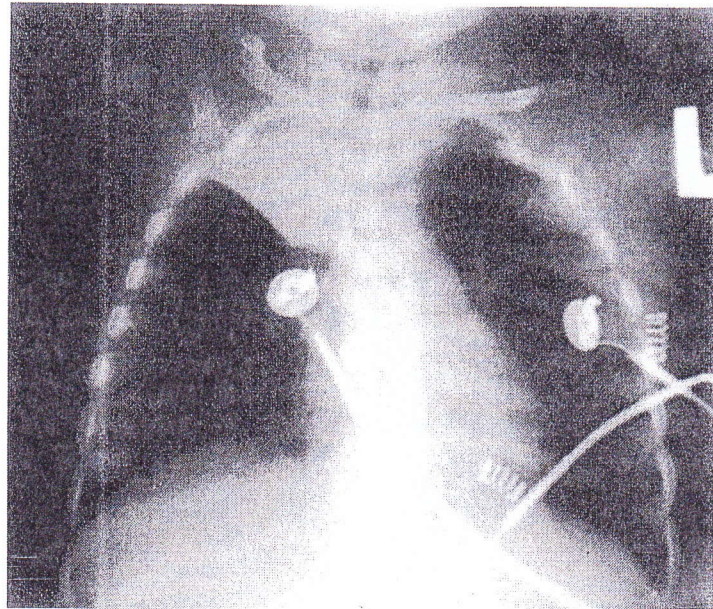
- There is homogeneous opacity occupying the upper part of the Rt lung
- No mediastinal shift [Tracheal air column & Heart] = Central mediastinum
- Picture of right upper lobar consolidation

Diagnosis: Rt upper lobe pneumonia



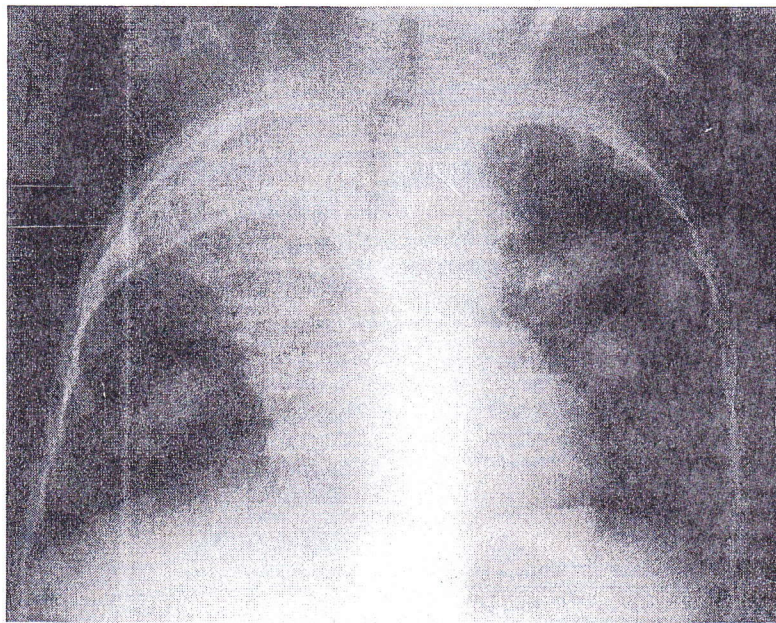
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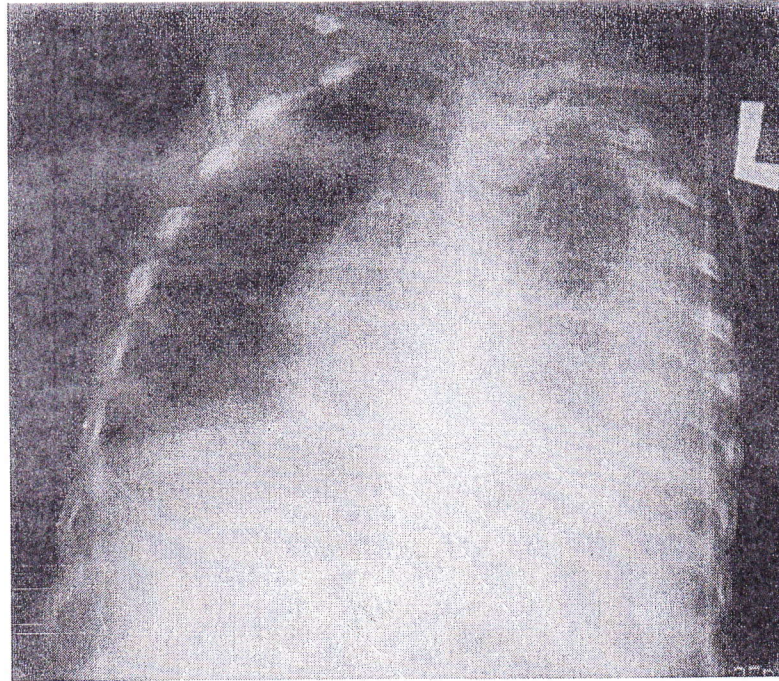
- There is homogeneous well-defined triangular opacity occupying the upper part of the Rt lung with an outer concave border
- Trachea is shifted to the right side [Heart is not shifted]
- The rest of the Rt lung is hypertranslucent (Compensatory emphysema)
- Nyle tube & leads
- Picture of right upper lobe collapse

Diagnosis: Rt upper lobe collapse



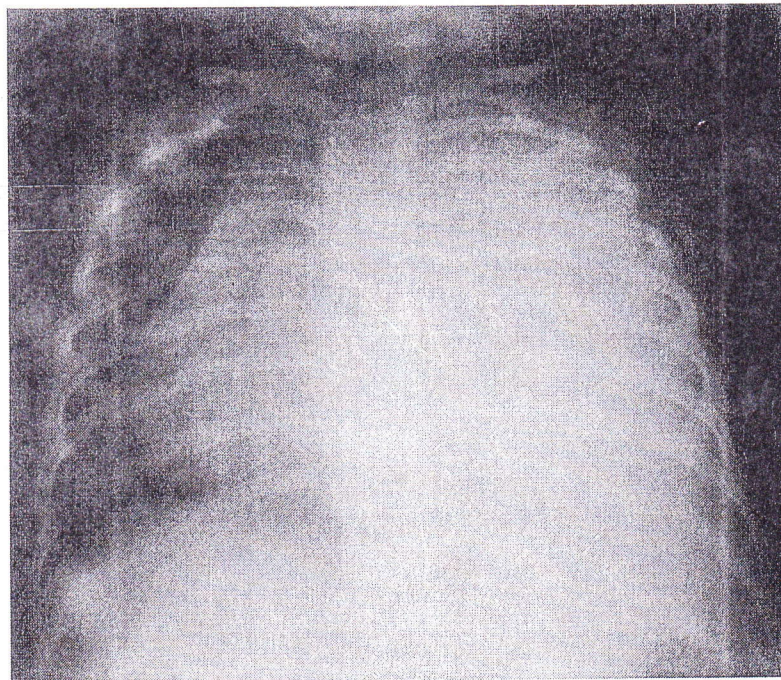
- There is homogeneous triangular opacity occupying the upper & middle parts of the Rt lung
- The mediastinum [Tracheal air column & Heart] is shifted to the same side (Right)
- Picture of right upper & middle lobe collapse

Diagnosis: Rt upper & middle lobe collapse



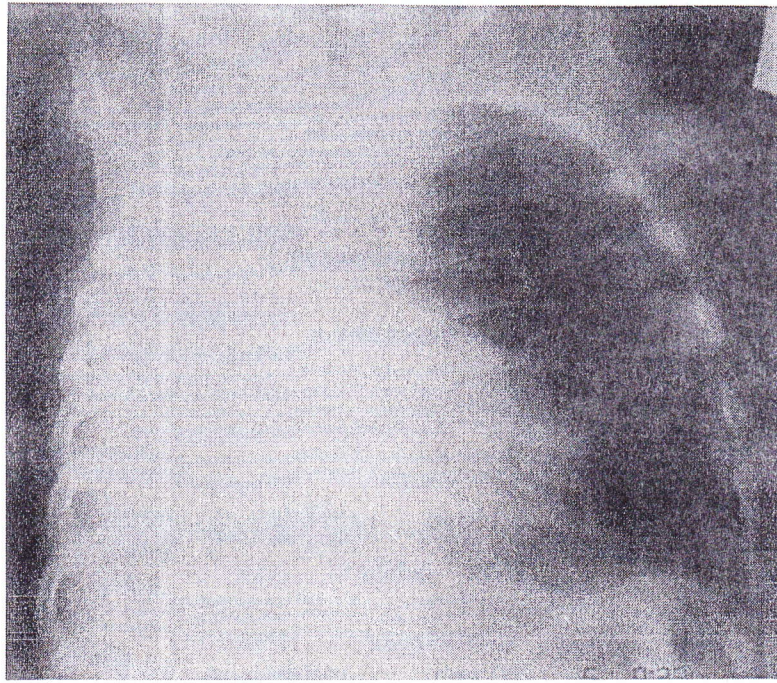
- There is homogeneous opacity occupying most of the Lt hemithorax, obliterating the Lt C/P angle & rising to the axilla
- The Lt lung is collapsed
- The mediastinum [Tracheal air column&Heart] is shifted to the opposite side (right)

Diagnosis: Lt moderate pleural effusion



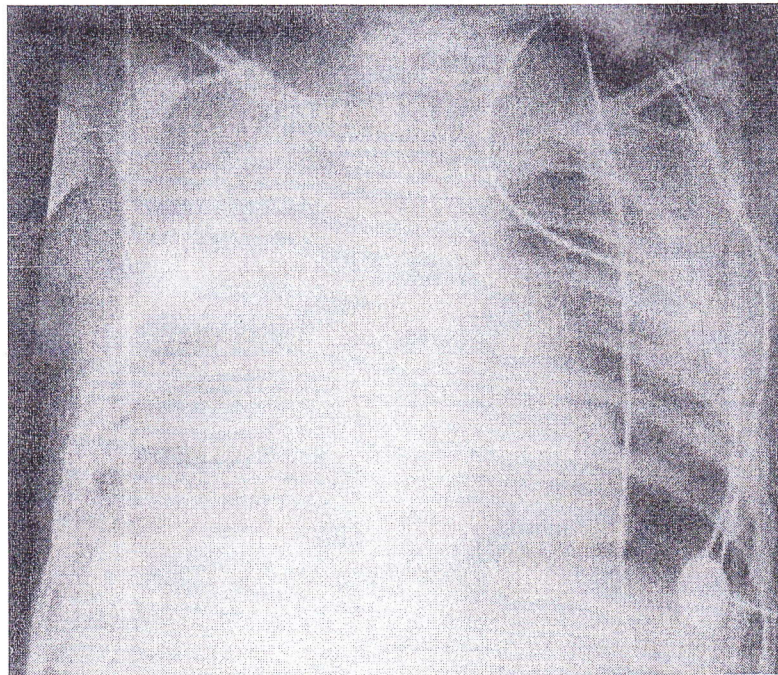
- There is homogeneous opacity obliterating the Lt C/P angle & occupying the whole Lt hemithorax
- The mediastinum [Tracheal air column&Heart] is shifted to the opposite side (right)

Diagnosis: Lt massive pleural effusion



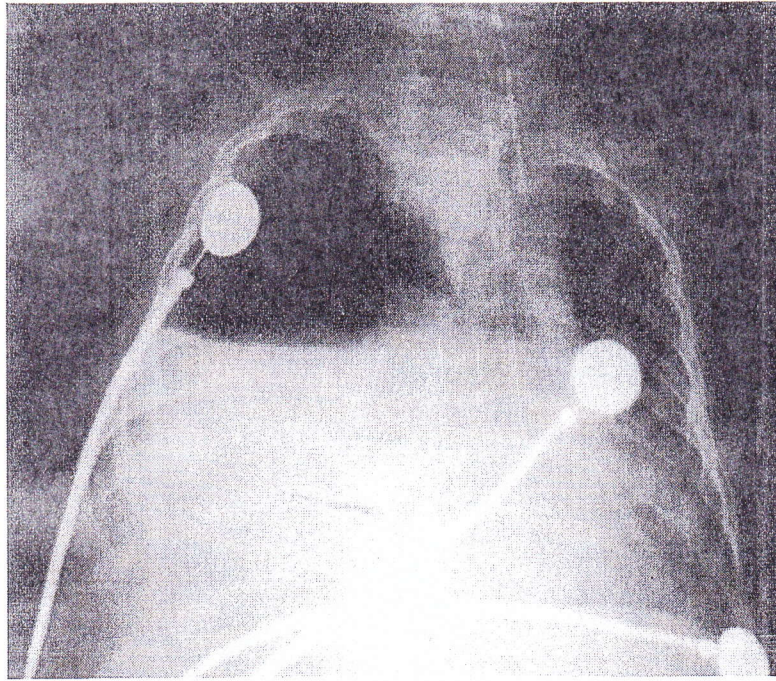
- There is homogeneous opacity occupying the whole Rthemothorax
- The mediastinum [Tracheal air column & Heart] is shifted to the same side (Right)
- Transmediastinal herniation of the upper lobe of the left lung
- Picture of massive right lung collapse

Diagnosis: Massive right lung collapse



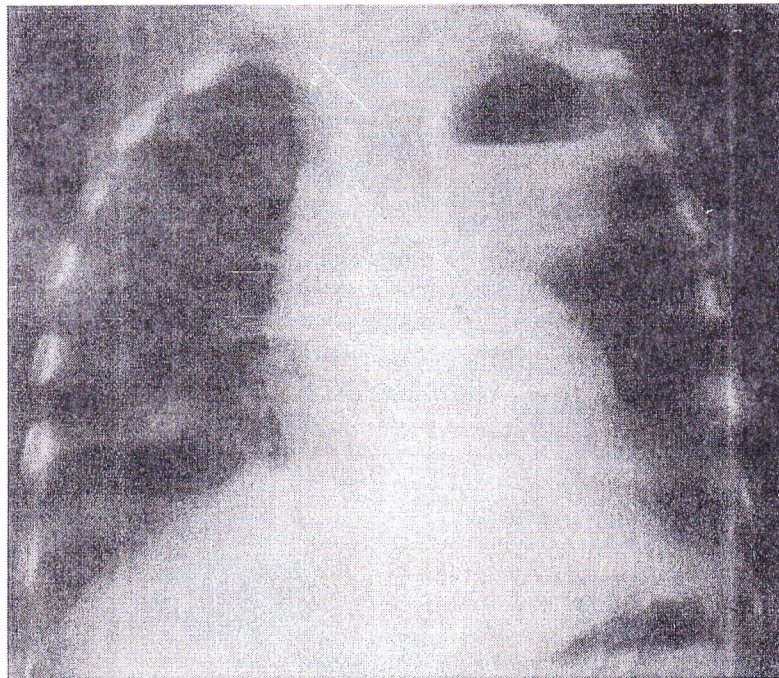
- There is homogeneous opacity occupying most of the Rt lung
- No mediastinal shift [Tracheal air column & Heart] = Central mediastinum
- ETT & leads
- Picture of massive right lung consolidation

Diagnosis: Massive right lung consolidation



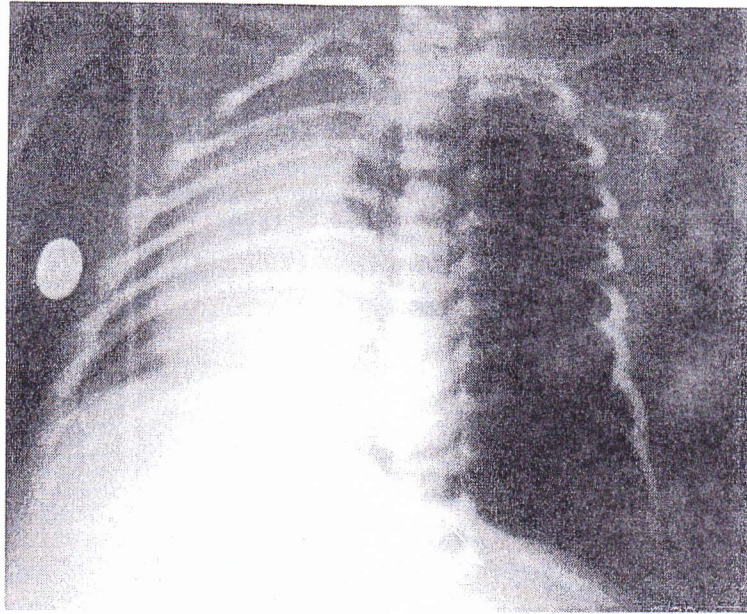
- There is heterogeneous opacity occupying the lower part of the Rthorax, obliterating the Rt C/P angle with an upper transverse border (Air-Fluid level)
- The upper part of the Rthorax is hypertranslucent "jet black" with No BVM
- The mediastinum [Tracheal air column & Heart] is shifted to the opposite side (Left)

Diagnosis: RtHydropneumothorax



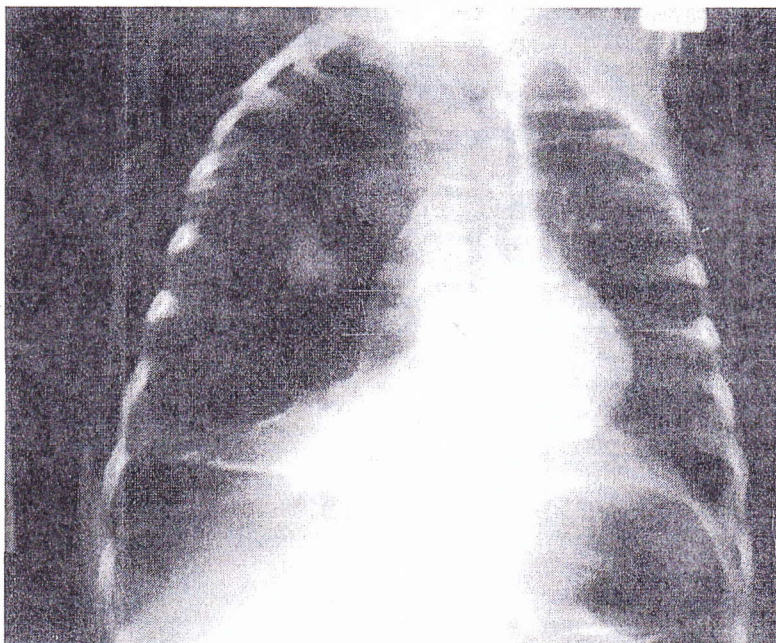
- The upper part of the Rt lung shows a thick-walled, well-defined cavity. The lower part of the lesion shows homogenous opacity with an upper transverse border (Fluid) while the upper part of the lesion is jet black with No BVM (Air)
- No mediastinal shift [Tracheal air column & Heart] = Central mediastinum
- Bilateral free C/P angles

Diagnosis: Lt upper lobe lung abscess



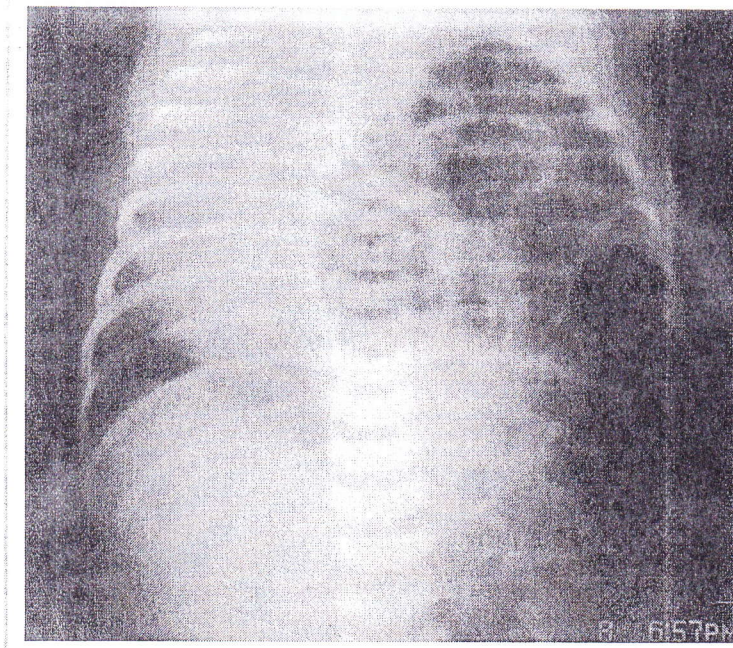
- The left hemithorax shows jet black hypertranslucency with absent BVMs
- Downward displacement of the left diaphragmatic copula
- Wide spacing of the ribs (on the left side)
- The mediastinum [Tracheal air column&Heart] is shifted to the opposite side(Right)

Diagnosis: Lt sided pneumothorax



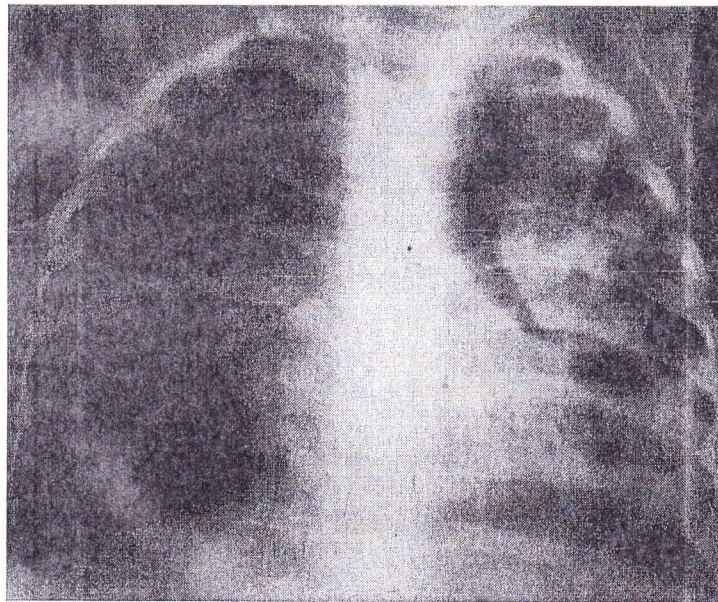
- The right hemithorax shows jet black hypertranslucency with absent BVMs
- Downward displacement of the right diaphragmatic copula
- Wide spacing of the ribs (on the right side)
- The mediastinum [Tracheal air column&Heart] is shifted to the opposite side (Left)
- The Rt lung is collapsed towards the hilum
- Hypertranslucency is seen outside Rt chest wall elevating the skin (Surgical emphysema)
- Rt intercostal tube (Drainage of pneumothorax) is seen

Diagnosis: Rt sided pneumothorax with compression collapse of the Rt lung



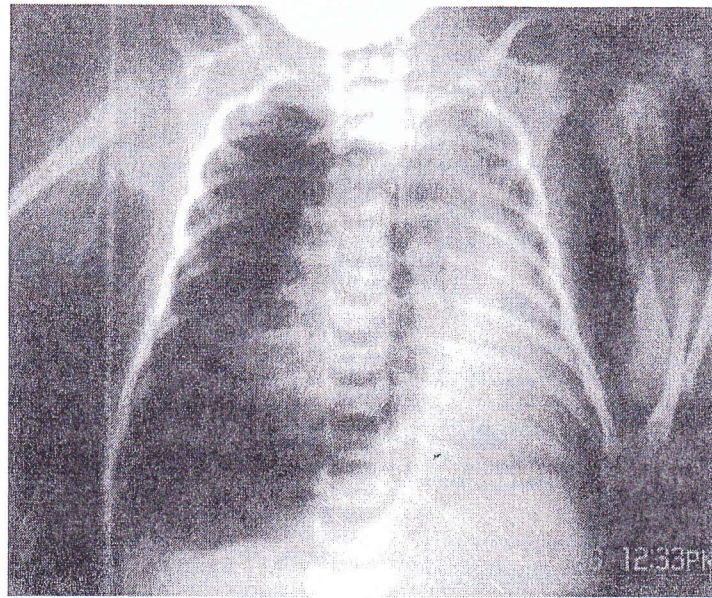
- Multiple radiolucent areas simulating pneumatocoeles communicating with abdominal air and intermingled with heterogenous opacities simulating pneumonia
- Non-visualized Lt diaphragmatic copula
- The mediastinum [Tracheal air column&Heart] is shifted to the opposite side (right)

Diagnosis: Lt sided congenital diaphragmatic hernia



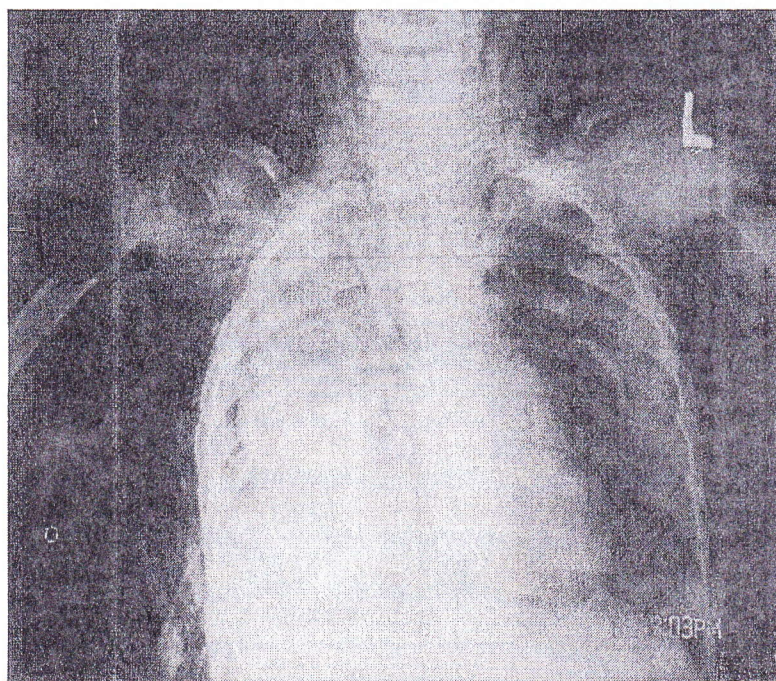
- The middle & lower zones of the Lt lung show heterogeneous opacities (Pneumonic consolidation) with multiple airspaces surrounded by thin walls (Pneumatocoeles)
- Pneumatocoeles are Not communicating with the abdominal air
- Intact Lt diaphragmatic copula
- No mediastinal shift [Tracheal air column & Heart] = Central mediastinum

Diagnosis: Lt sided pneumonia & pneumatocoeles



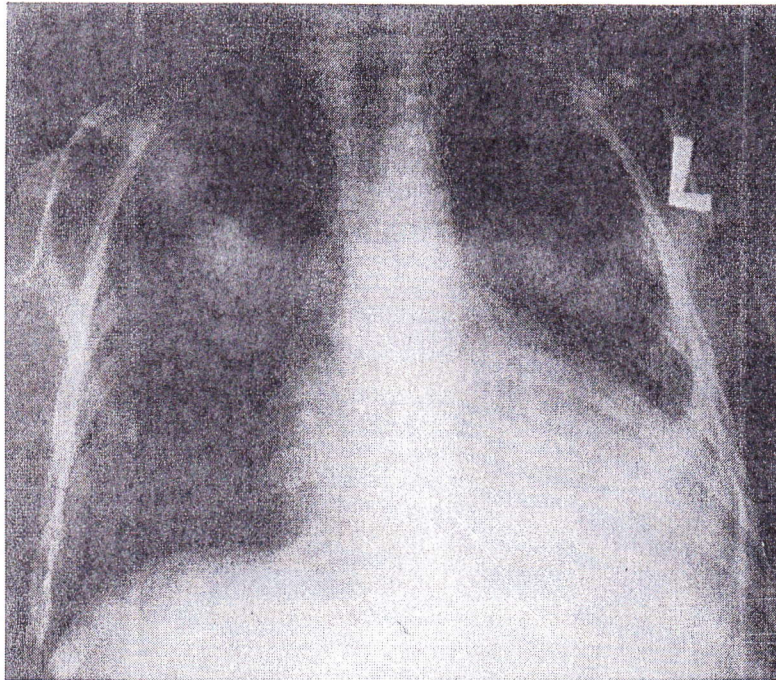
- The right hemithorax shows jet black hypertranslucency with absent BVMs
- Downward displacement of the right diaphragmatic cupola
- Wide spacing of the ribs (on the right side)
- The mediastinum [Tracheal air column & Heart] is shifted to the opposite side (Left)
- The Rt lung is collapsed towards the hilum
- ETT & Rt intercostal tube (Drainage of pneumothorax) are seen

Diagnosis: Rt sided pneumothorax with compression collapse of the Rt lung



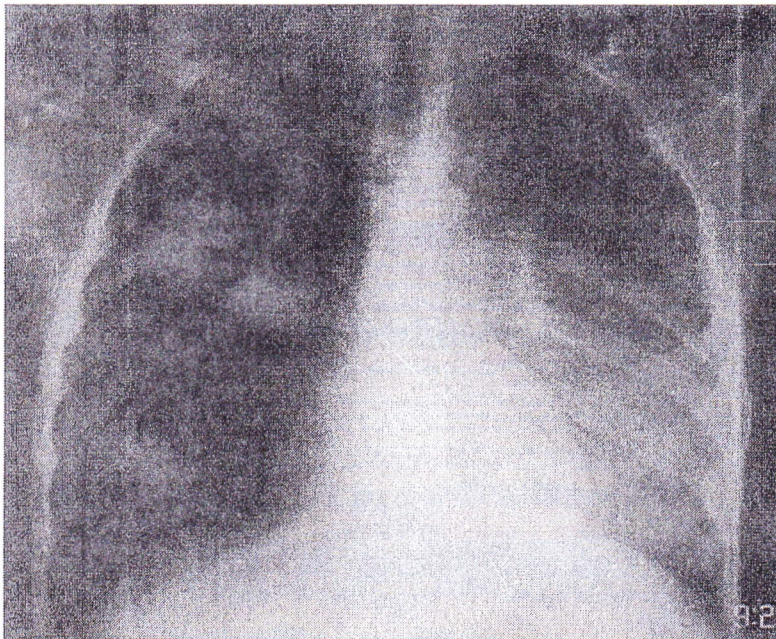
- 2 IC tubes are seen on the Rt side (Pneumothorax)
- Hypertranslucency is seen outside chest wall elevating the skin bilaterally & extending upwards to involve the skin the neck (Surgical emphysema)

Diagnosis: Surgical emphysema??



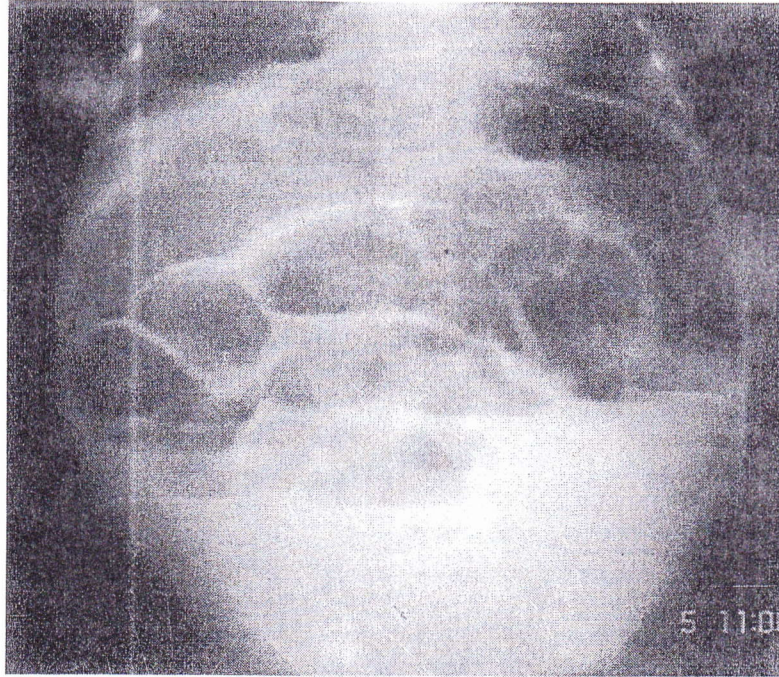
- There is homogeneous opacity obliterating the Lt C/P angle & rising to the axilla
- No mediastinal shift [Tracheal air column & Heart] = Central mediastinum

Diagnosis: Rt sided mild pleural effusion



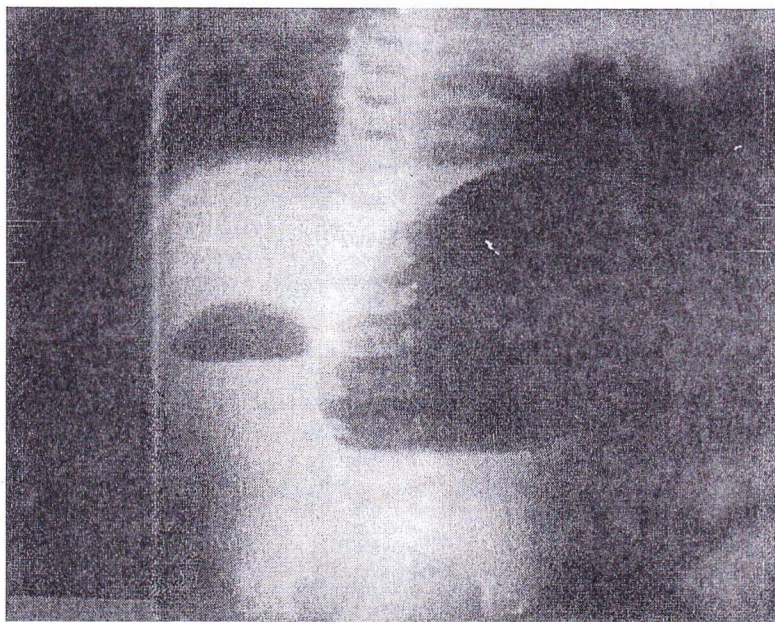
- There is homogeneous opacity occupying the lower part of the Lt lung
- No mediastinal shift [Tracheal air column & Heart]
- Picture of left lower lobar consolidation

Diagnosis: Lt lower lobe pneumonia



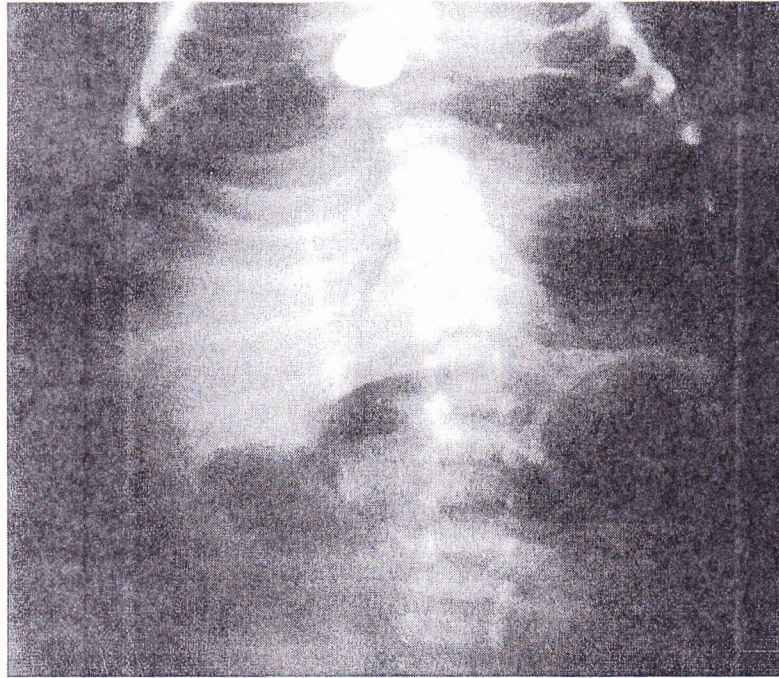
- Plain erect X-ray of the abdomen & chest
- Abdominal distension
- Lower part of the abdomen is devoid of gases (gasless)
- Multiple air-fluid levels

Diagnosis: Intestinal obstruction



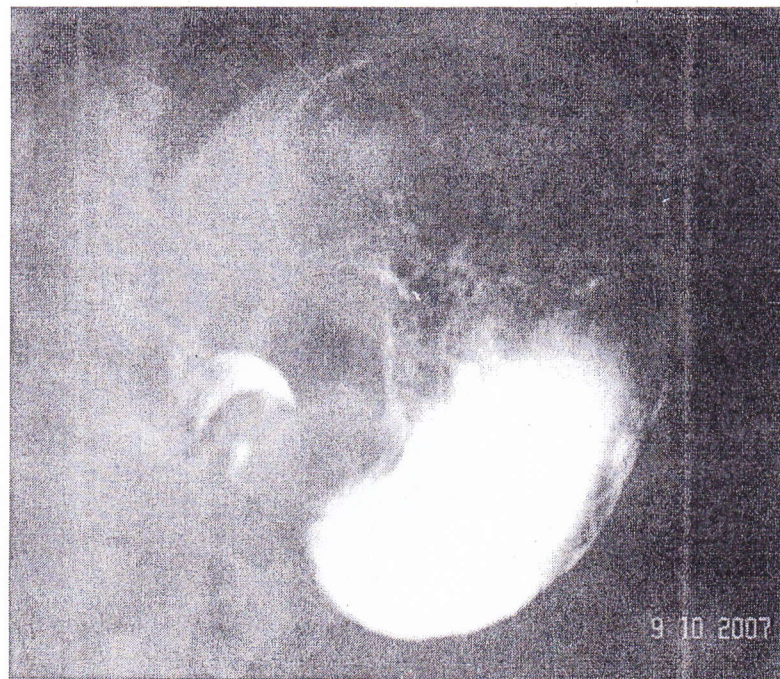
- Plain erect X-ray of the abdomen & chest
- 2 air-fluid levels
- Double bubble sign (Fluid in the stomach & duodenum)
- No gas distal to the obstruction
- No marked abdominal distension

Diagnosis: Duodenal atresia



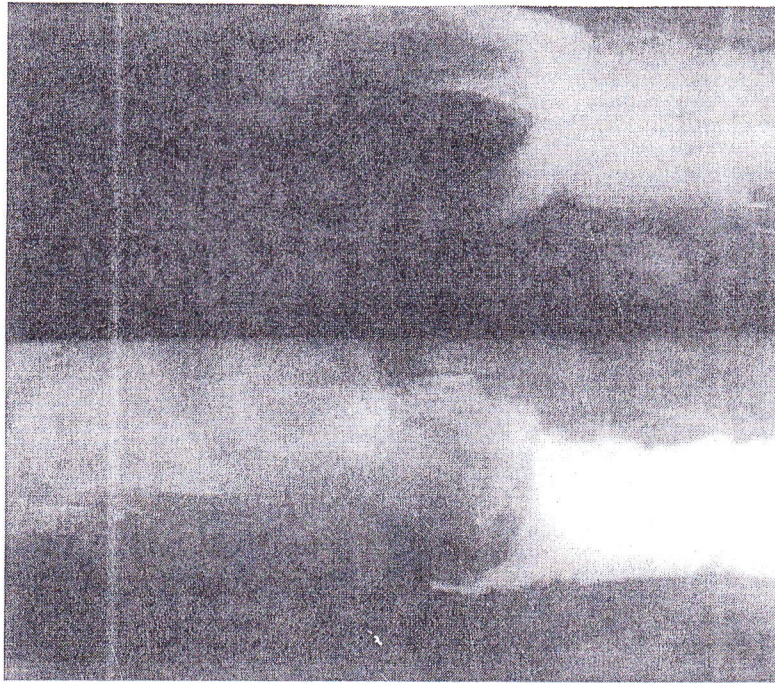
- Plain erect X-ray of the abdomen & chest
- Free air (Hypertranslucency) under the diaphragm along both copulae
- Abdominal viscera are pushed centrally
- Picture of pneumoperitoneum (Perforated viscus)

Diagnosis: Pneumoperitoneum



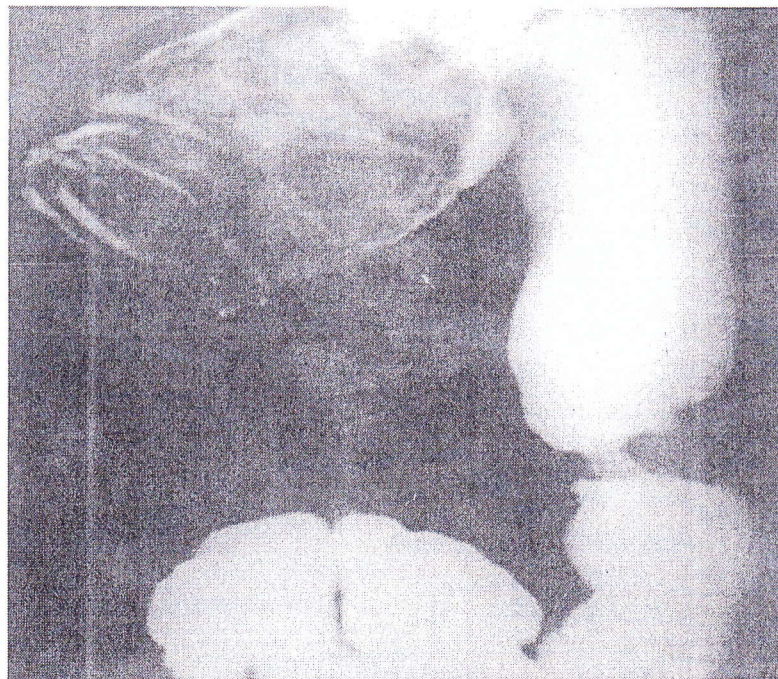
- Barium meal study of the stomach
- Marked dilatation of the stomach
- Narrow pyloric canal "**String sign**"
- Umbrella-shaped duodenal cap
- Delayed gastric emptying (Correlate with time!!)

Diagnosis: CHPS



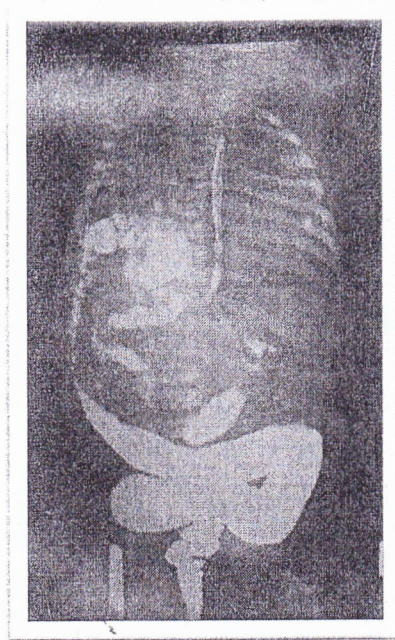
- Barium enema
- Sudden stoppage of the contrast at the area of the transverse colon
- Characteristic **claw sign** due to passage of the contrast between the intussusceptum & the intussusceptient

Diagnosis: Intussusception



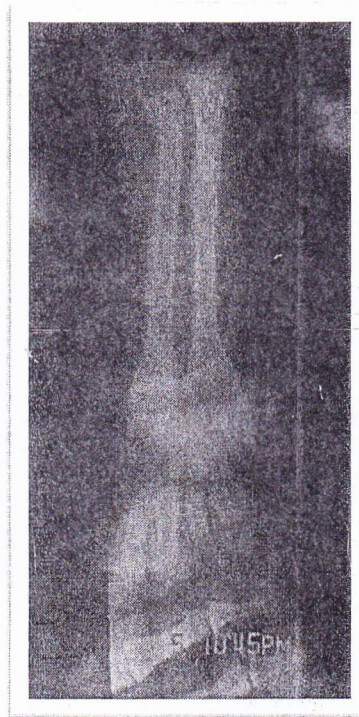
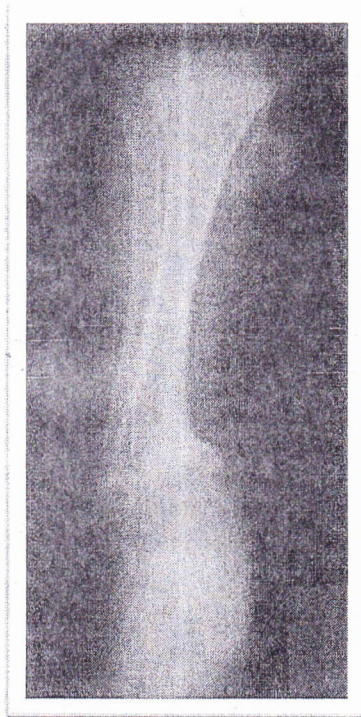
- Barium enema
- Sudden stoppage of the contrast at the area of the transverse colon
- Characteristic **coiled-spring sign** due to passage of the contrast between the intussusceptum & the intussusceptient

Diagnosis: Intussusception



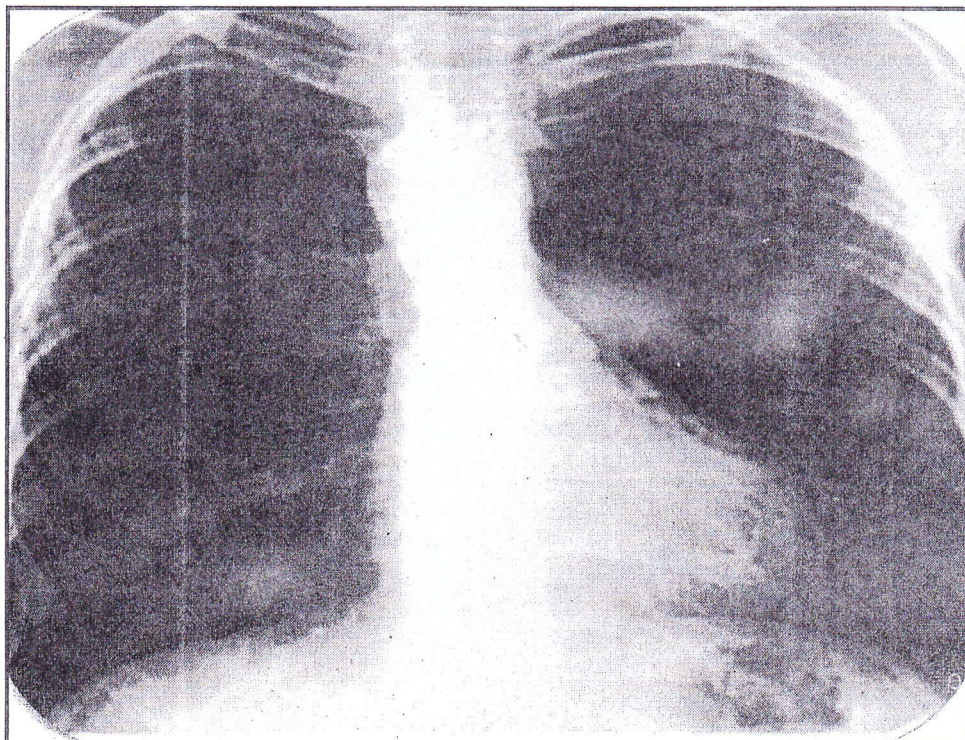
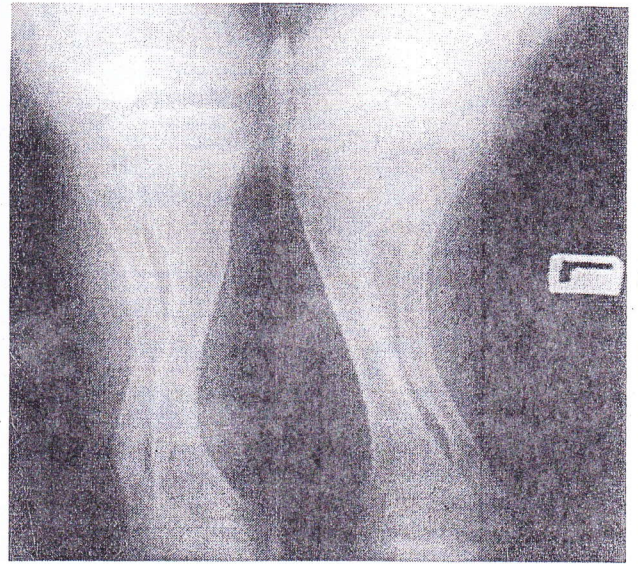
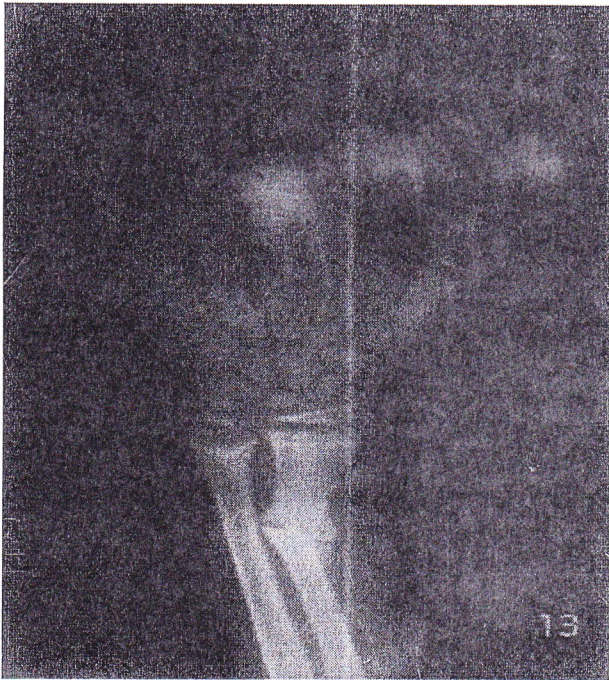
- Barium meal & follow-through
- Herniated barium filled intestinal loops into the Rt or Lt hemithorax
- The mediastinum [Tracheal air column & Heart] is shifted to the opposite side

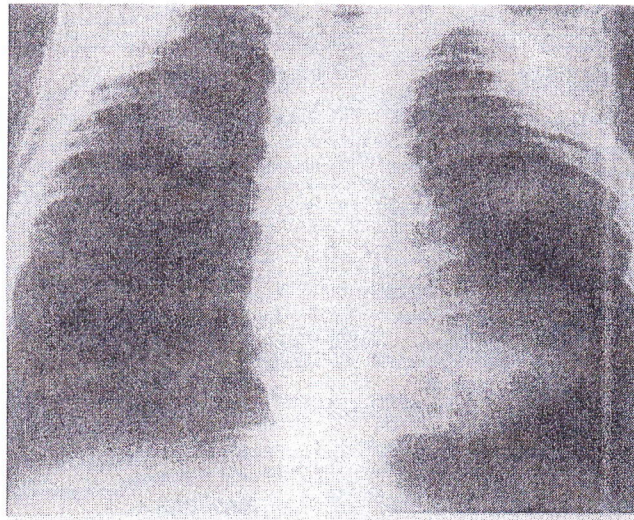
Diagnosis: Rt sided congenital diaphragmatic hernia



- Plain X-ray UL (Radius, Ulna, wrist & hand) & LL (Tibia, fibula, ankle & foot)
- Metaphysis: Broadening, Cupping, Fraying
- Diaphysis: ↓↓ Bone density, Double periosteal line & deformity (Bow legs)
- Epiphysis: ↑↑ Joint space
- Age ≈ 1 year (2 Carpal bones)

Diagnosis: Active rickets





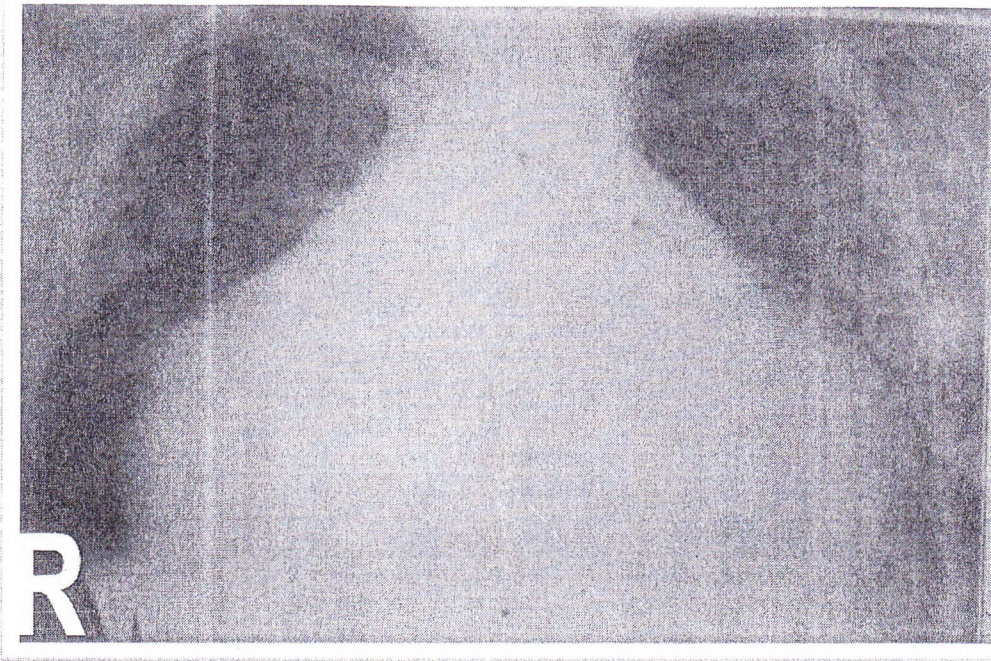
- Cardio-thoracic ratio is normal (or it may be mildly increased)
- Acute cardiophrenic angle with Uplifted apex (Rt ventricle hypertrophy)
- Exaggerated cardiac waist (Pulmonary hypoplasia)
- Decreased pulmonary vascular markings (Lung oligemia)

Diagnosis: Coeur en sabot: tetralogy of Fallot



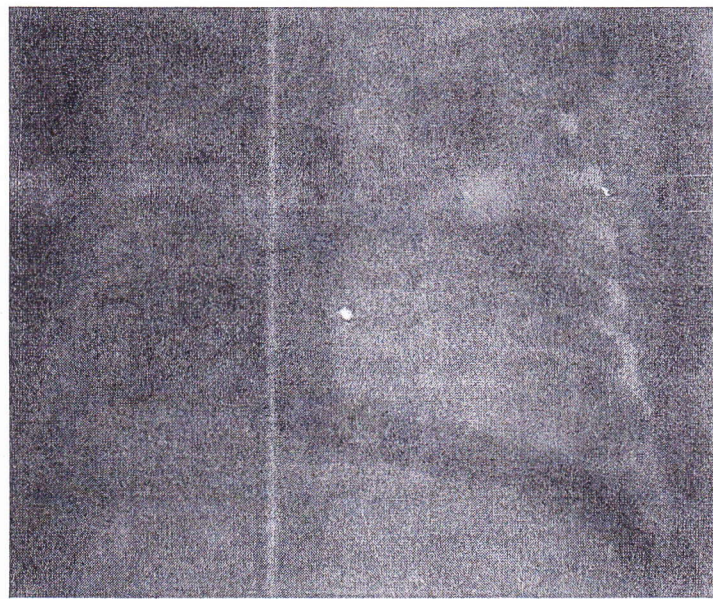
- Cardio-thoracic ratio increased (about 70%)
- acute cardiophrenic angle (right ventricle dilatation)
- Marked bulge of the right border (right atrium dilatation)
- Narrow cardiac pedicle overlapping of the aorta & pulmonary artery
- Increased pulmonary vascular markings (lung plethora)

Diagnosis: Cardiomegaly in the form of (Egg on side) most probably due to transposition of great arteries



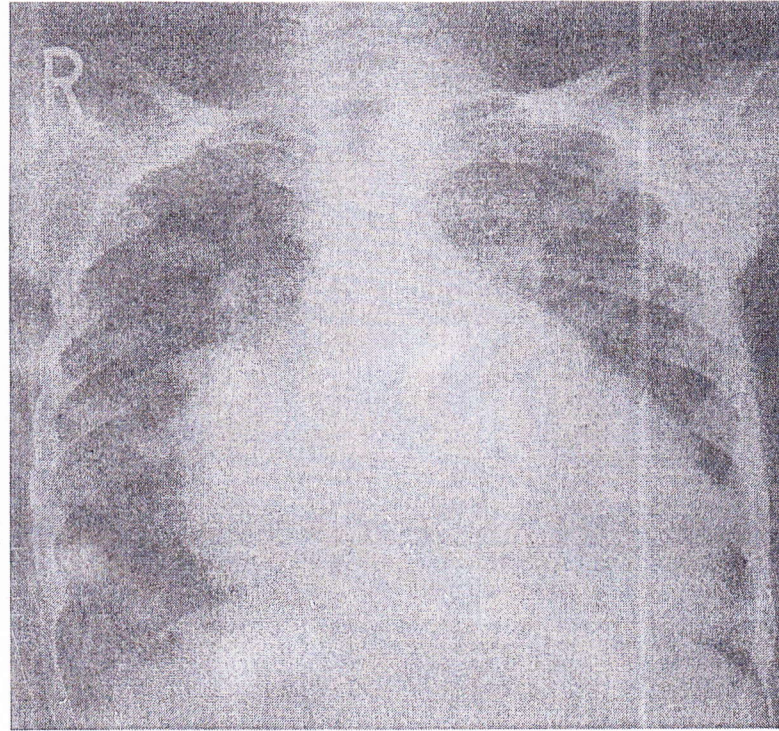
- Marked increase in the cardio-thoracic ratio (about 90 %)
- Symmetrical bulge of the left and right cardiac borders
- The borders are very well defined (Stenciled)
- Broad cardiac base (accumulation of fluid)
- Normal pulmonary vascular markings

Diagnosis: Cardiomegaly in the form of (flask shaped) most probably due to pericardial effusion



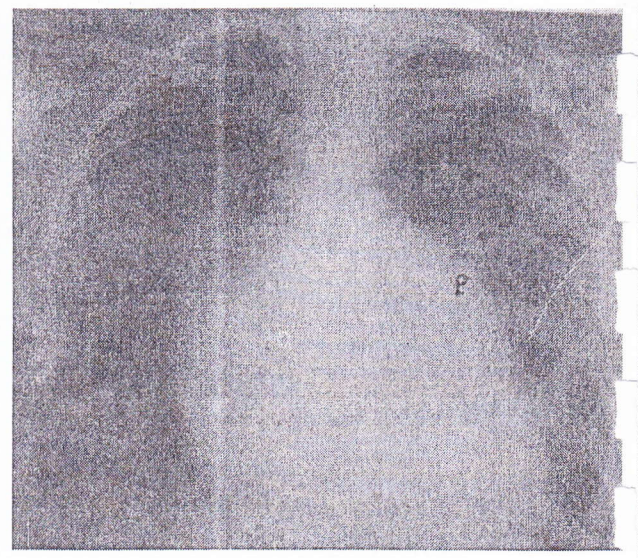
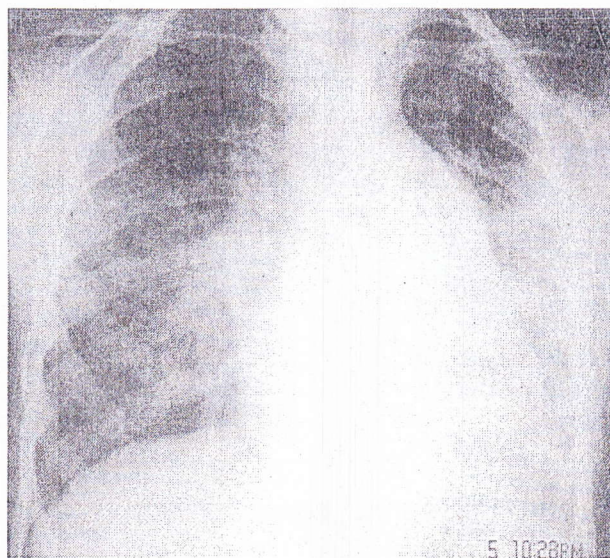
- Cardio-thoracic ratio is normal
- There is area of jet black translucency surrounding the cardiac shadow (air in the pericardial sac)

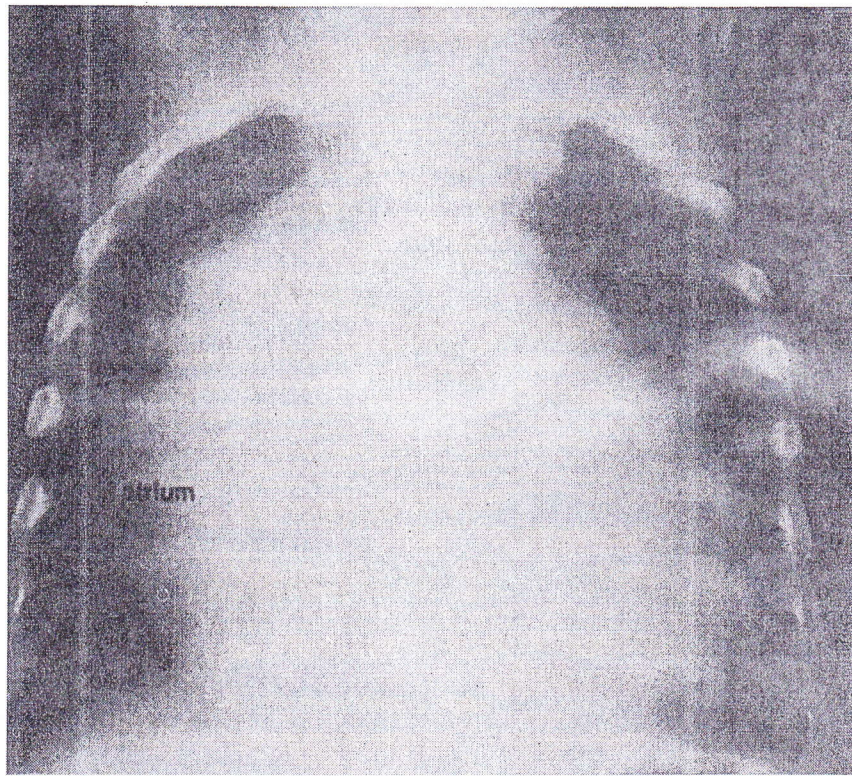
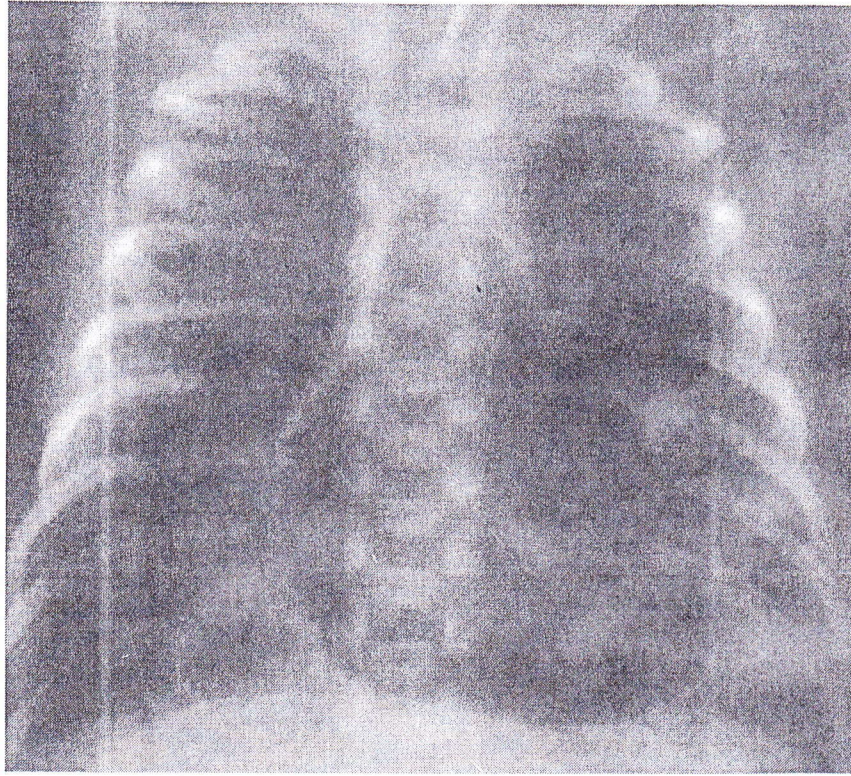
Diagnosis: Pneumopericardium

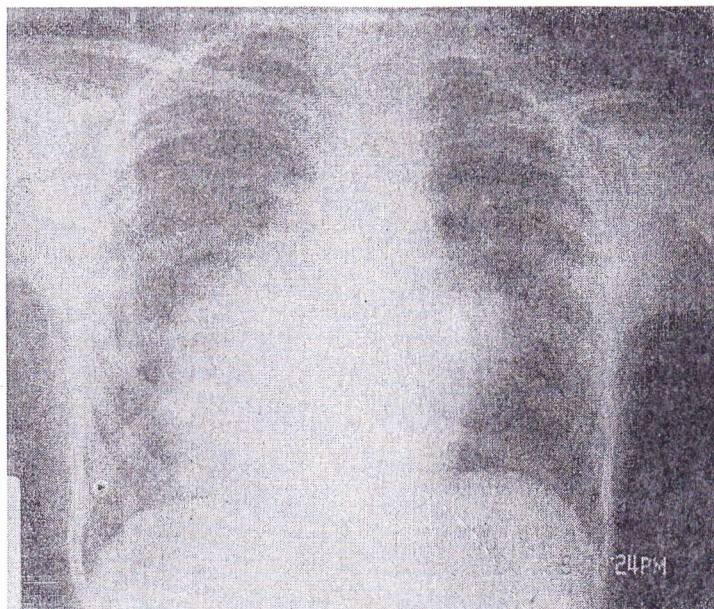


- Cardio-thoracic ratio increased (about 70%) denoting cardiomegaly
- obtuse cardiophrenic angle on the left side (left ventricle dilatation)
- Straight left cardiac border (waist obliteration): mitralized heart: dilated left atrium and pulmonary artery
- Bulging right cardiac border (right atrium dilatation)
- Increase pulmonary vascular markings (hilar congestion extending upward)

Diagnosis: Cardiomegaly due to enlargement of left ventricle, left atrium, pulmonary artery and right atrium, for differential diagnosis (most probably due to RHD)

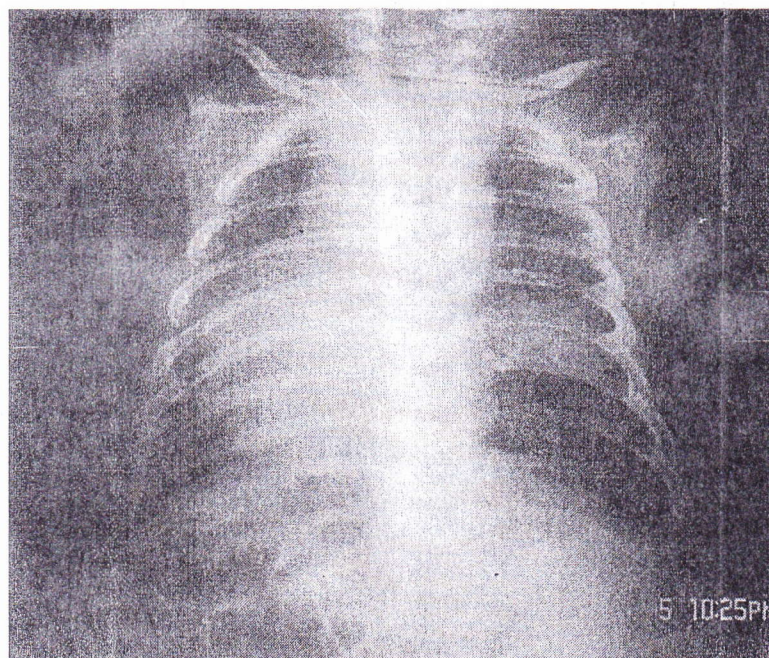






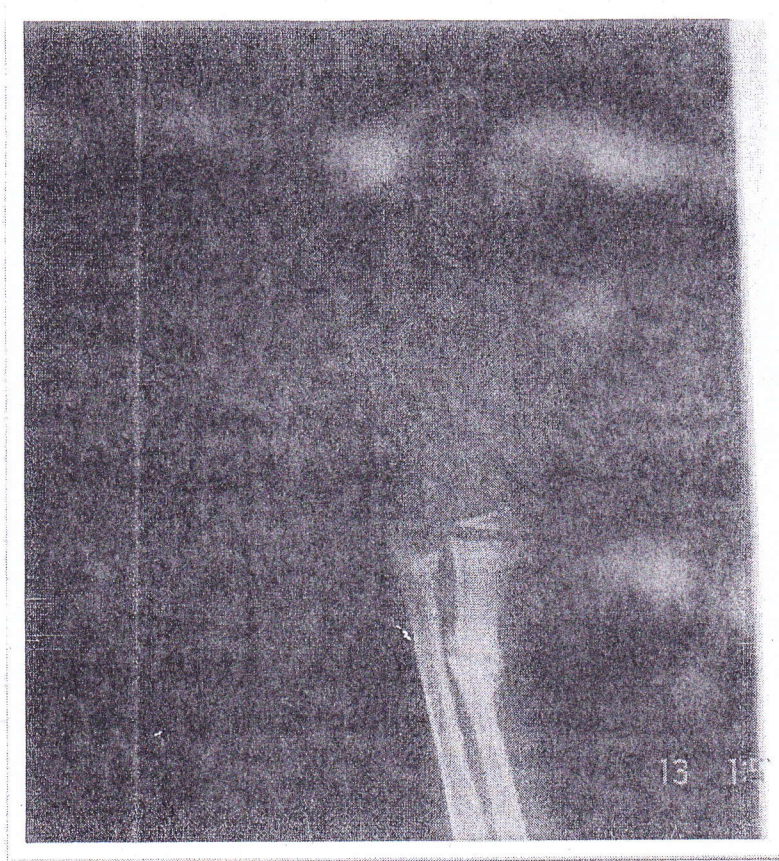
- Abnormal position of the heart mainly to the right
- The left border of the heart which is made mainly by the LV is to the Rt
- The right border of the heart which is made mainly by the RA is to the Lt
- CT ratio increased (about 60%) denoting cardiomegaly (associate anomaly)
- Liver shadow & gastric air bubble are in normal place (No situsinversus)

Diagnosis: Isolated dextrocardia

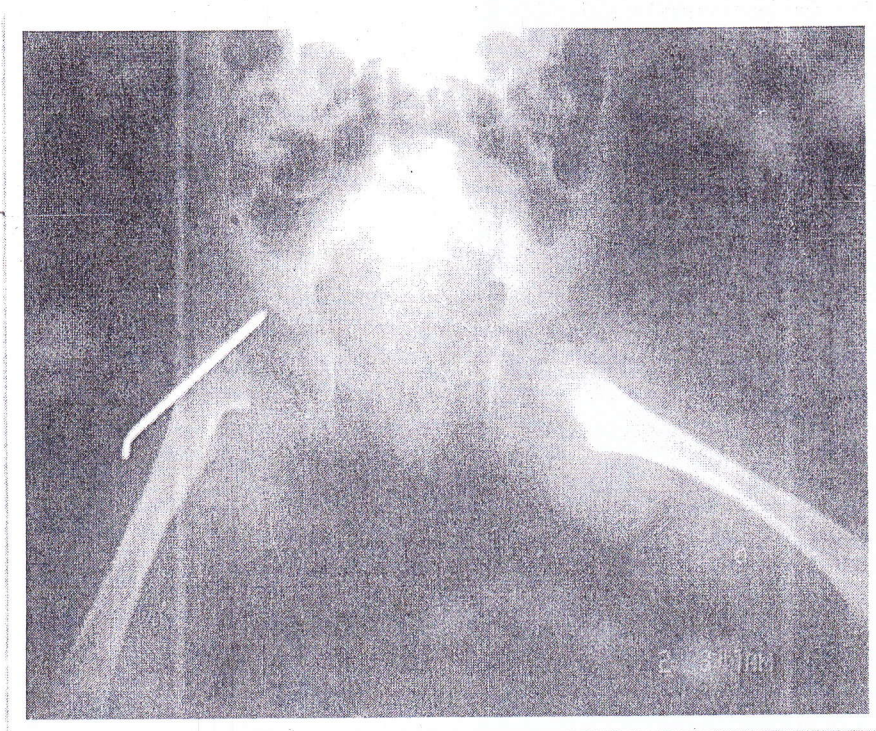


- Abnormal position of the heart mainly to the right
- The left border of the heart which is made mainly by the LV is to the Rt
- The right border of the heart which is made mainly by the RA is to the Lt
- CT ratio is normal
- Liver shadow is to the left
- Gastric air bubble is on the right side (situsinversus)

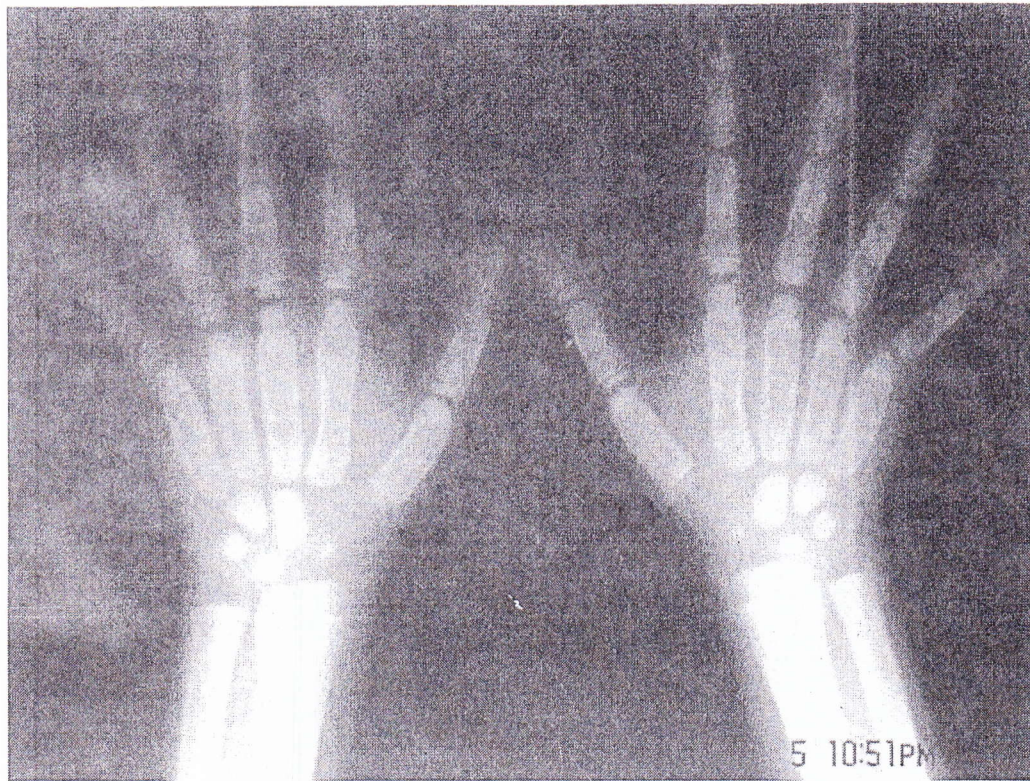
Diagnosis: Situsinversustotalis



Diagnosis: Non-nutritional Rickets



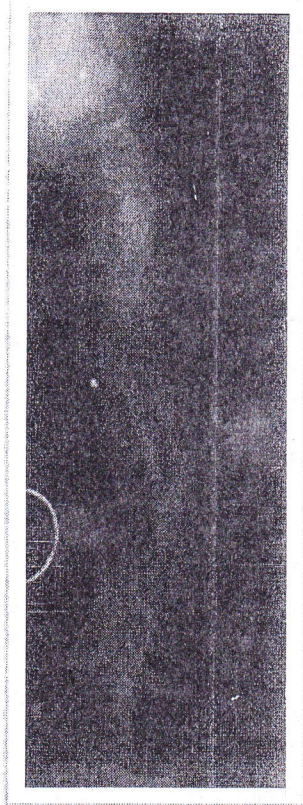
Diagnosis: DDH



Diagnosis: Chronic hemolytic anemia



Diagnosis: Osteopetrosis



Diagnosis: Osteogenesis imperfecta



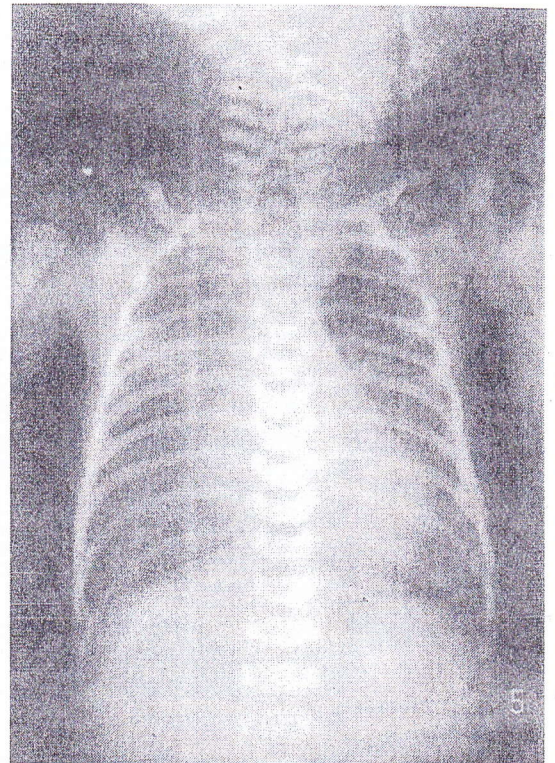
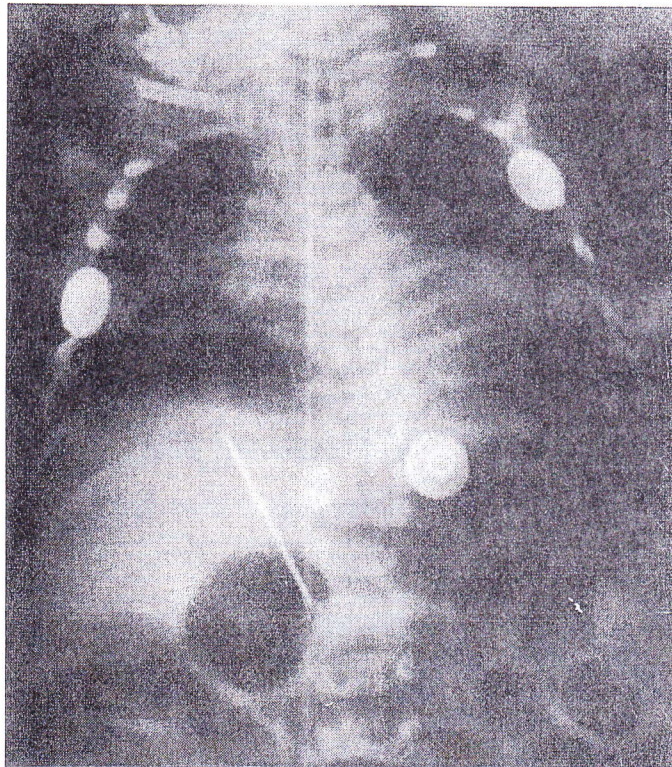
Diagnosis: MPS



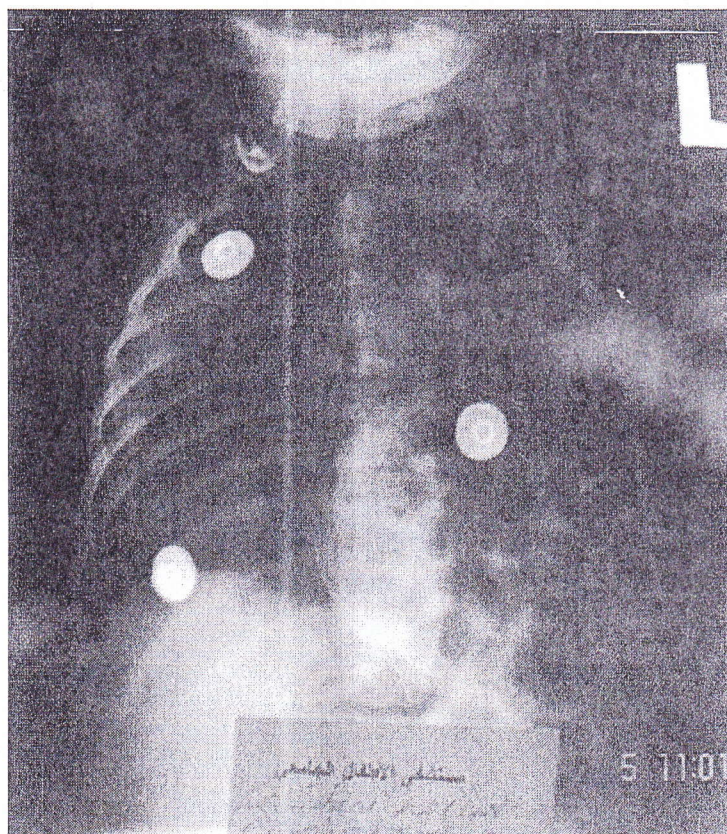
Diagnosis: Achondroplasia



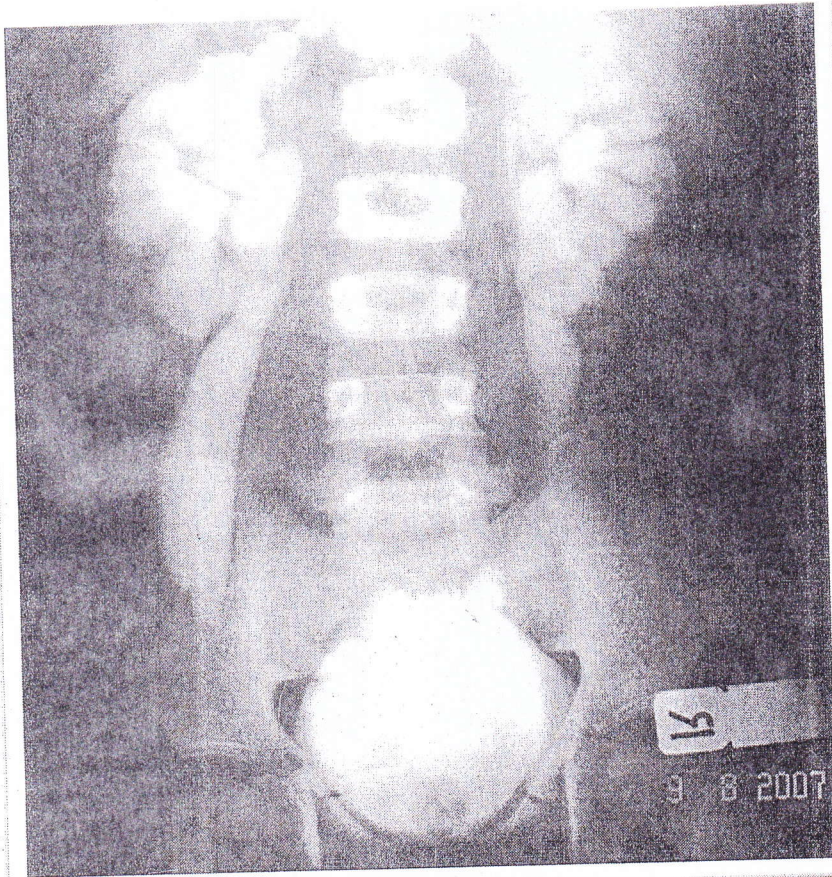
Diagnosis: HSD



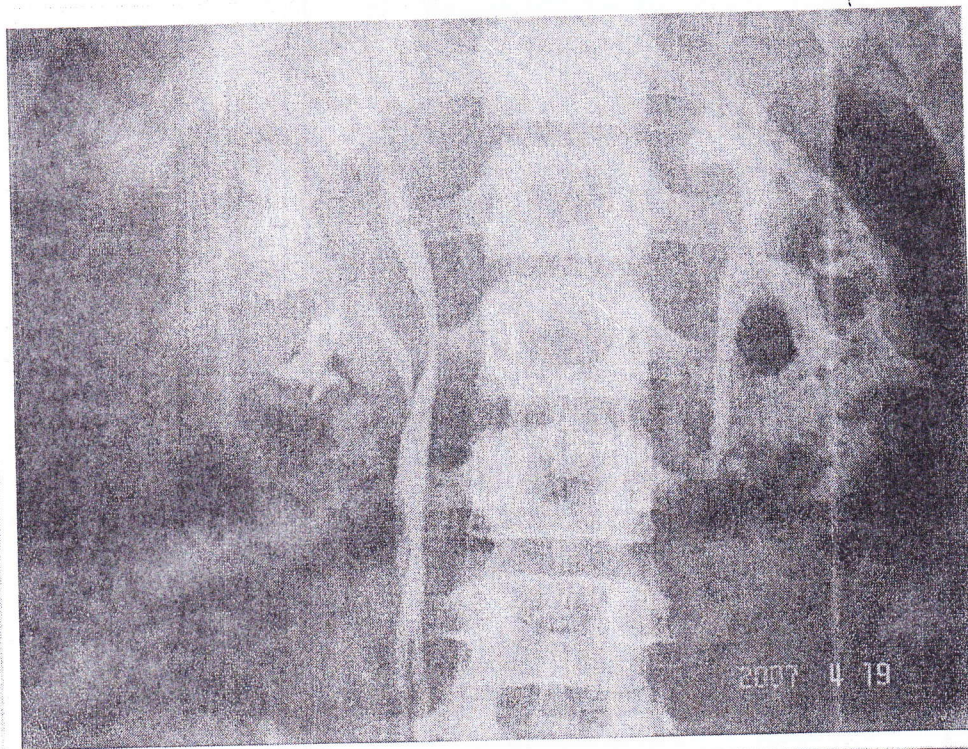
Diagnosis: TOF



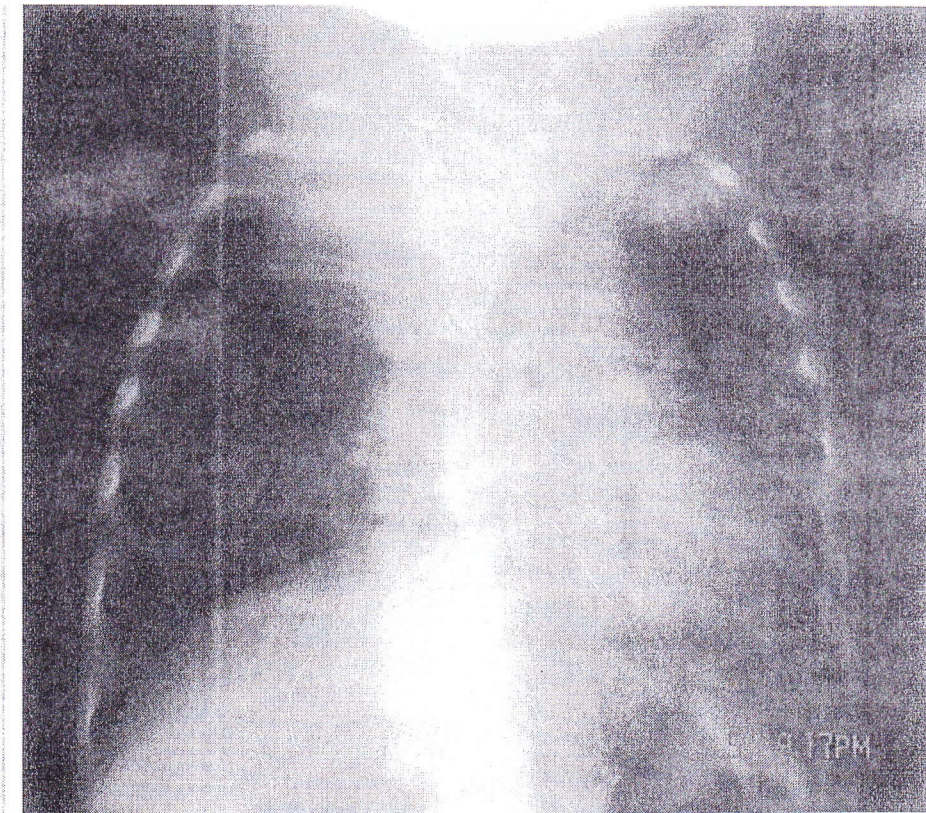
Diagnosis: Diaphragmatic eventration



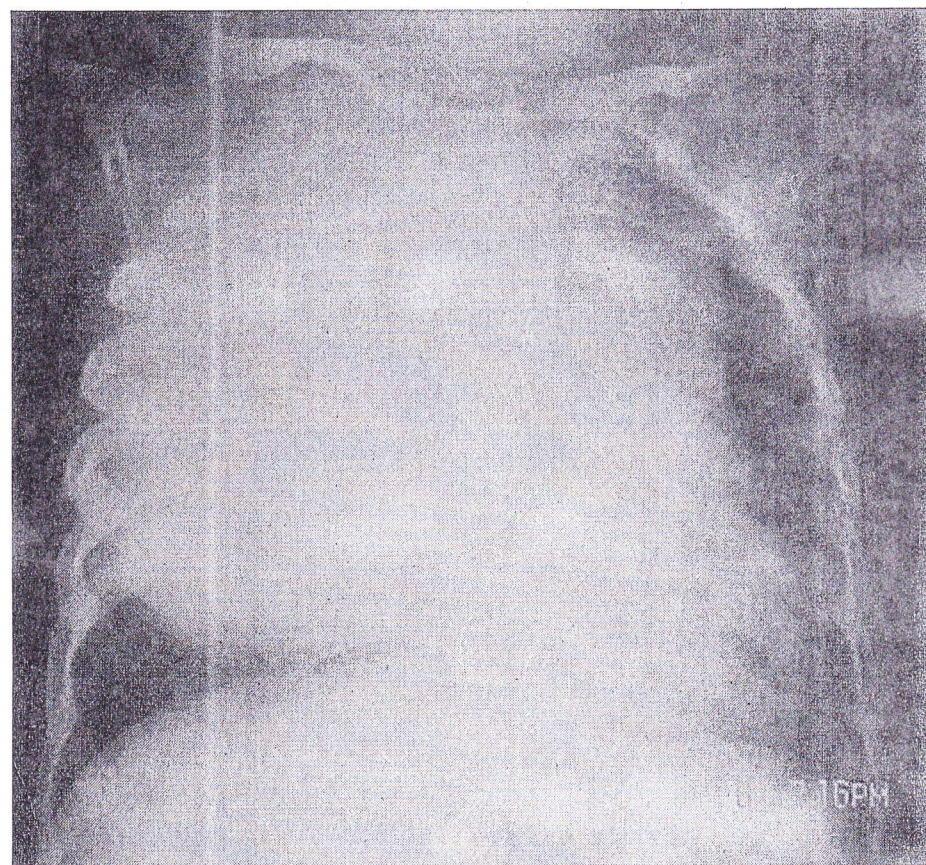
Diagnosis: VCUG, VUR Grade 5



Diagnosis: IVP Renal duplex



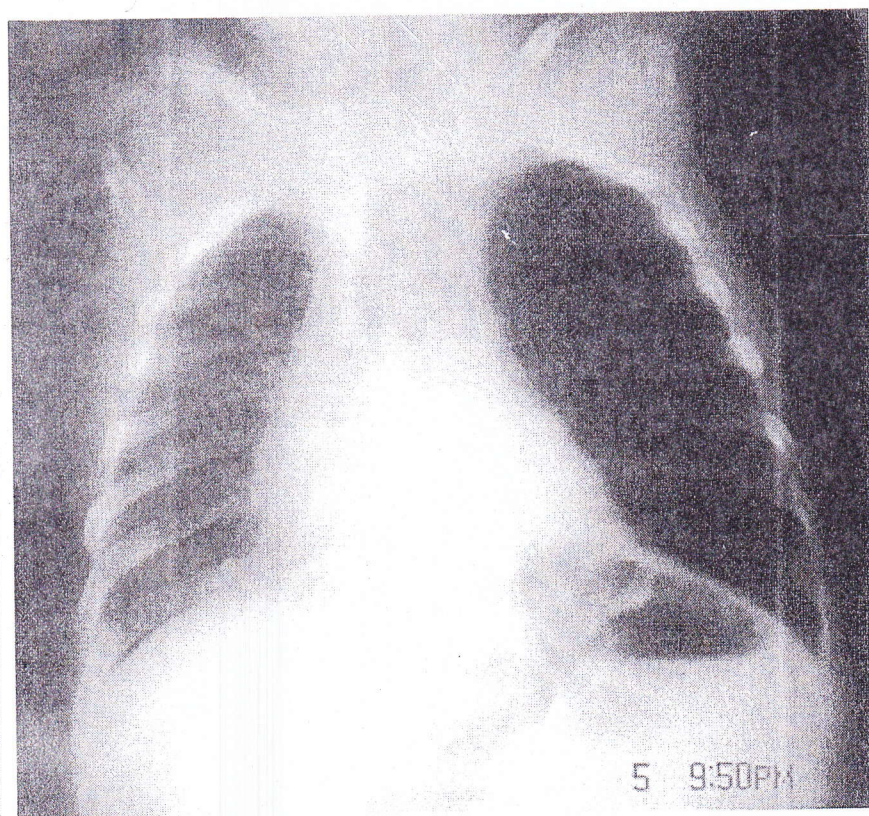
Diagnosis: Superior mediastinal mass



Diagnosis: Superior mediastinal mass



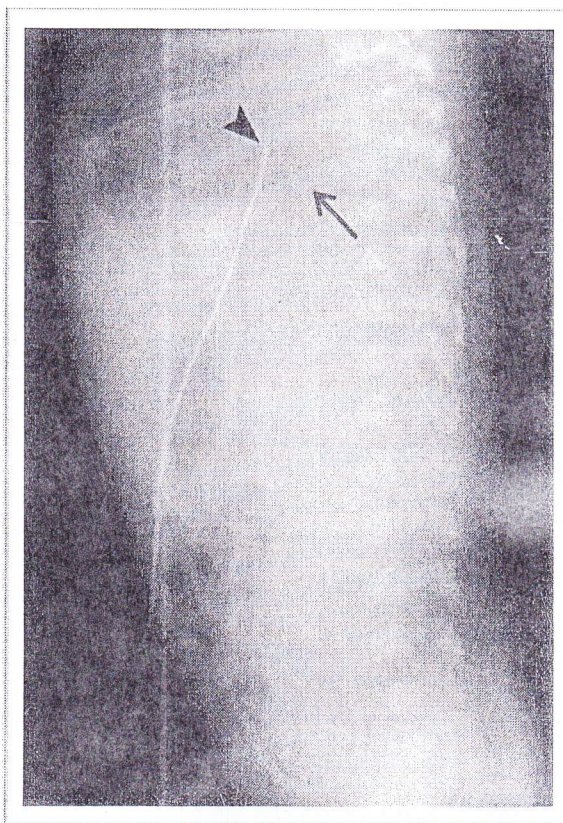
Diagnosis: RDS



Diagnosis: Congenital lobar emphysema



Diagnosis: NEC



Diagnosis: Umbilical Catheters

CT Brain

Comment

- Plain CT brain
- Plain CT brain
- Level: Single or multiple levels "Mention"
- Side: Right or Left
- Lobe (Frontal, parietal, temporal, occipital, cerebellar)
- Hyper-, Hypo- or Isodense
- Effects: e.g., hydrocephaly, Midline shift...
- Shunt (Ventricular end of the VP shunt)

Levels of CT Brain

F) Supraventricular level

- Gray & white matter

G) Level of the body of the lateral ventricle

- Bodies of lateral ventricles

H) Level of the horns of the lateral ventricle (= Level of the 3rd ventricle)

- Quadrigeminal cistern
- Basal ganglia (Remember BG Calcifications)

I) Posterior cranial fossa level (Infraventricular level)

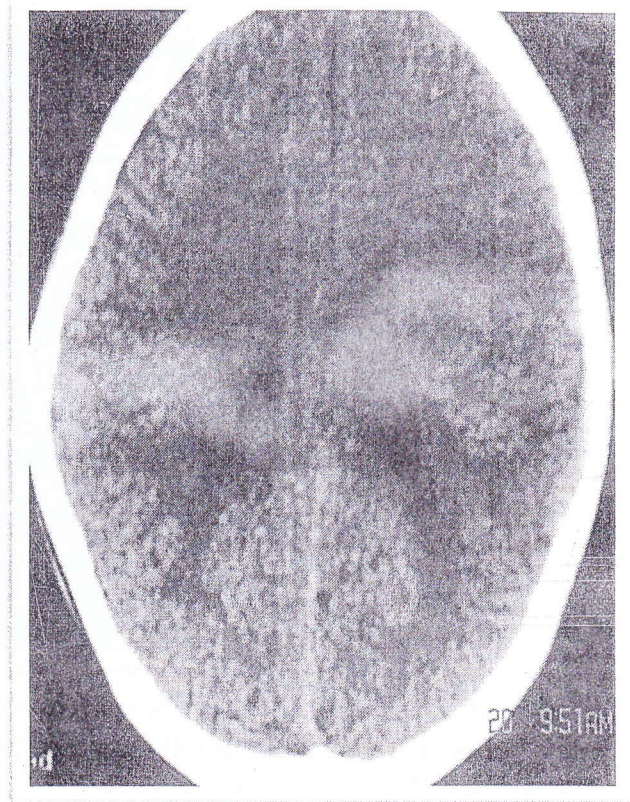
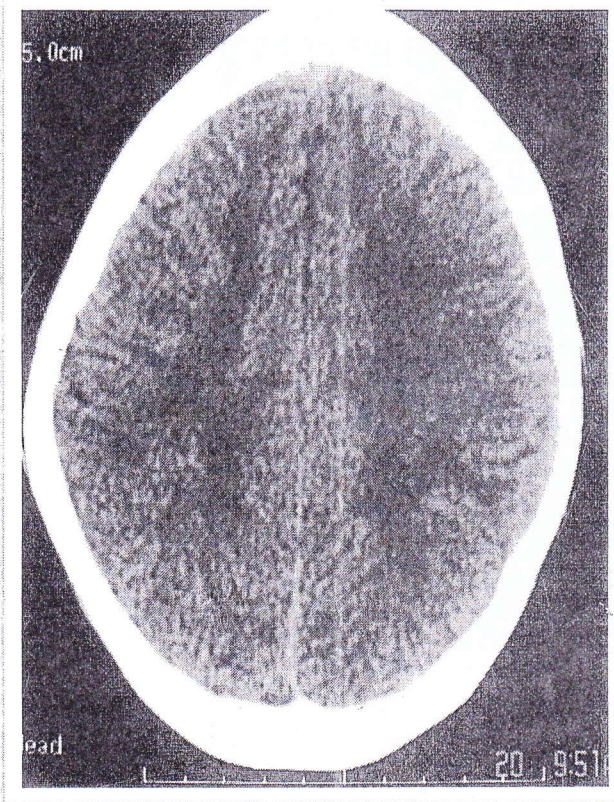
- 4th ventricle
- Posterior fossa tumors

Densities in the CT Brain

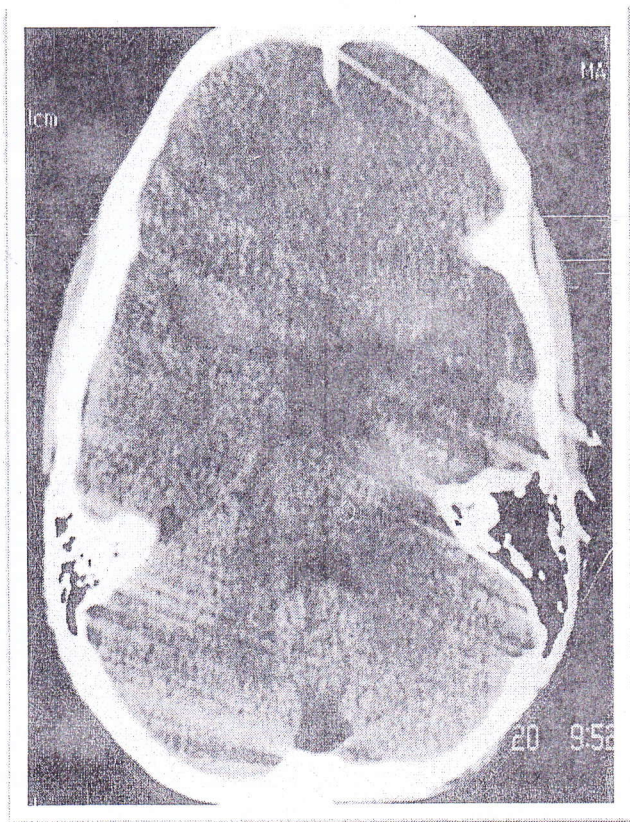
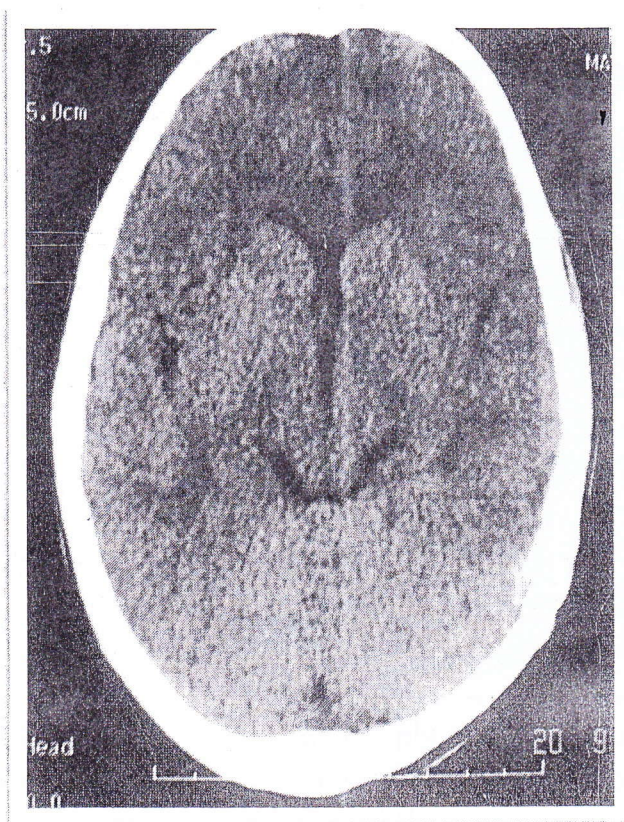
Hyperdense lesions	Hypodense lesions
Bones	CSF
Hemorrhage	Air
Calcification	Edema
IV Contrast	Infarction

Important Landmarks in the CT Brain

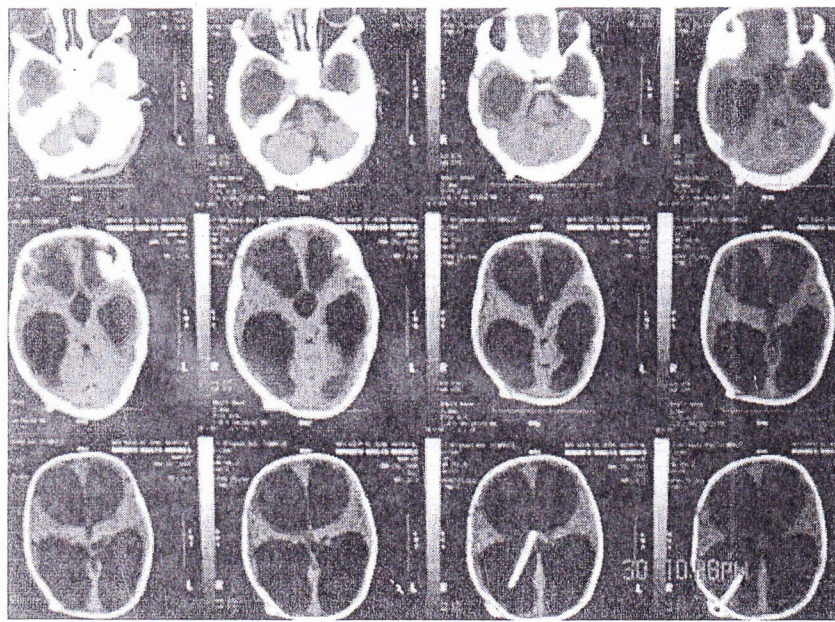
- Sylvian fissure: Temporal lobe
- Petrous part of the temporal bones: Posterior fossa level
- Center of the posterior cranial fossa: 4th ventricle



Supraventricular level **Level of the Bodies of LV**

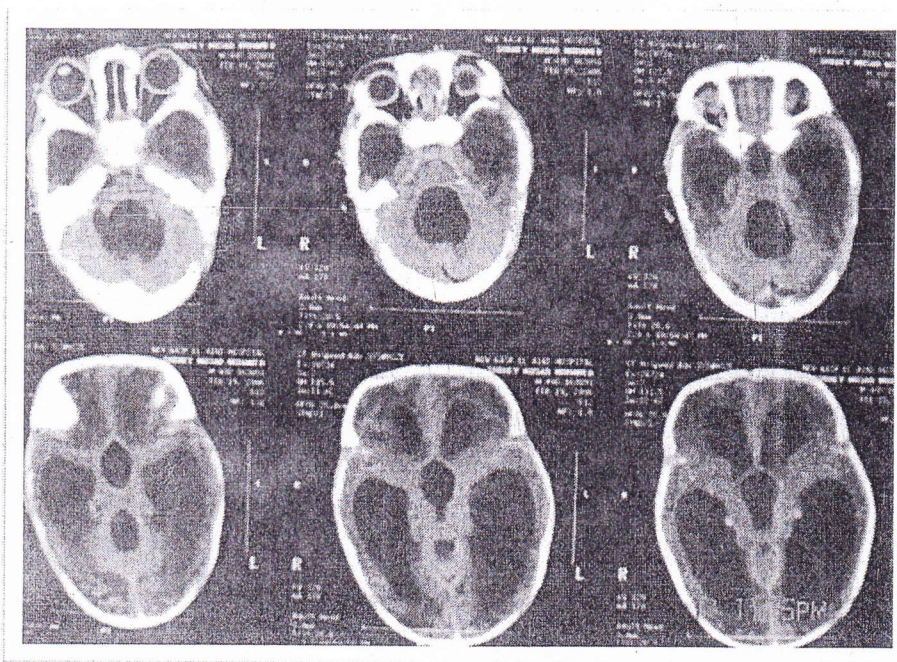


Level of the horns of LV **Posterior fossa level**



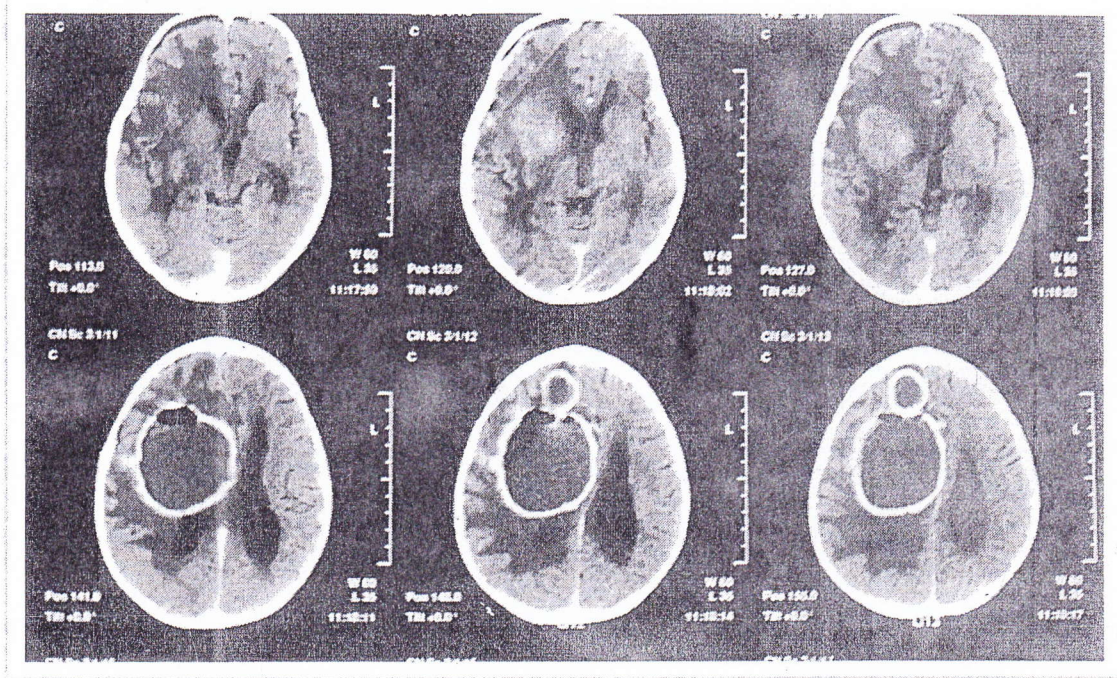
- Plain CT brain at multiple levels (horns of the lateral ventricles, post. fossa level)
- There is marked dilatation of the bodies & horns of the lateral ventricles
- Ballooning of The 3rd ventricle
- **Normal** 4th ventricle
- Ventricular shunt is seen on the Rt side

Diagnosis: Obstructive hydrocephalus with the level of obstruction at the aqueduct of sylvius most probably aqueductal stenosis



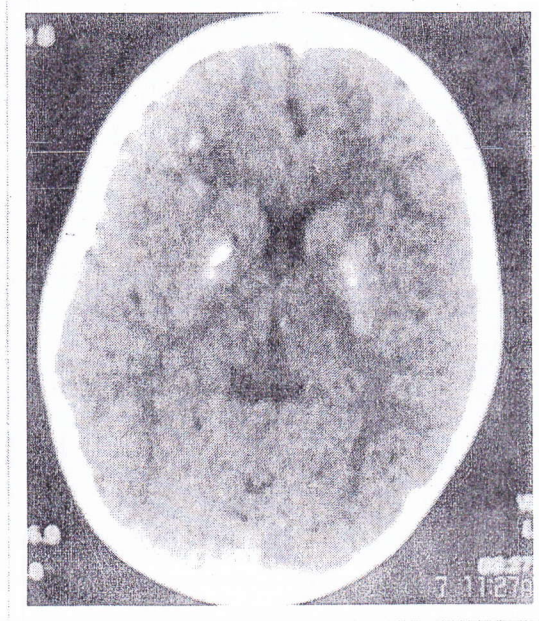
- Plain CT brain at multiple levels (3rd ventricle & posterior fossa)
- There is marked dilatation of the horns of the lateral ventricles
- Ballooning of the 3rd ventricle
- **Dilated** 4th ventricle

Diagnosis: Communicating hydrocephalus



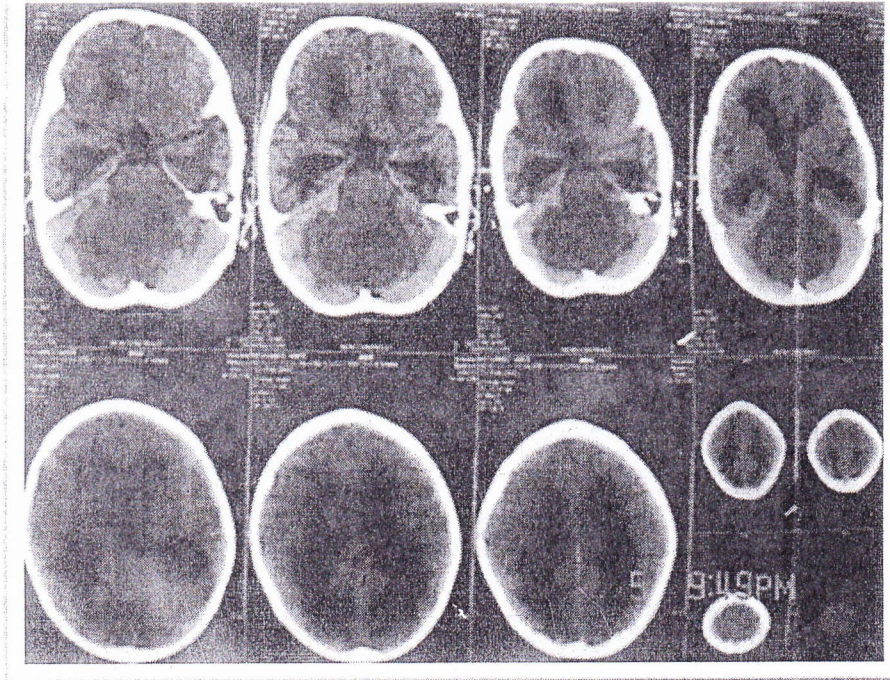
- CT brain with IV contrast at multiple levels (Bodies & horns of the lateral ventricles)
- Hypodense lesion in the Rtfronto-parietal area surrounded by hyperdense rim (Ring enhancement)
- The lesion is surrounded by a hypodense area (Brain edema)
- Mild dilatation of the bodies of the lateral ventricles

Diagnosis: Rtfronto-parietal brain abscess with 2ry hydrocephalic changes



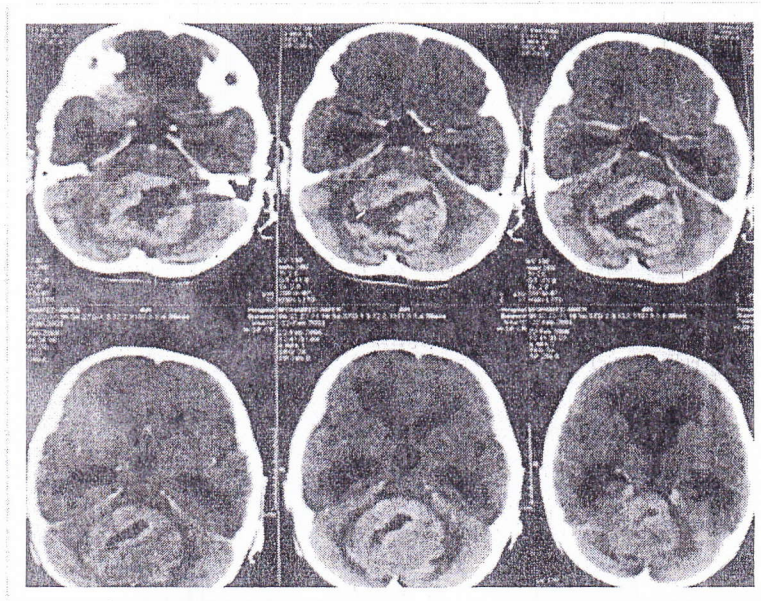
- Plain CT brain at the level of the 3rd ventricle
- Bilateral symmetric hyperdense areas at the region of the BG (Lentiform nuclei)
- ?Hypoparathyroidism

Diagnosis: Bilateral BG calcification



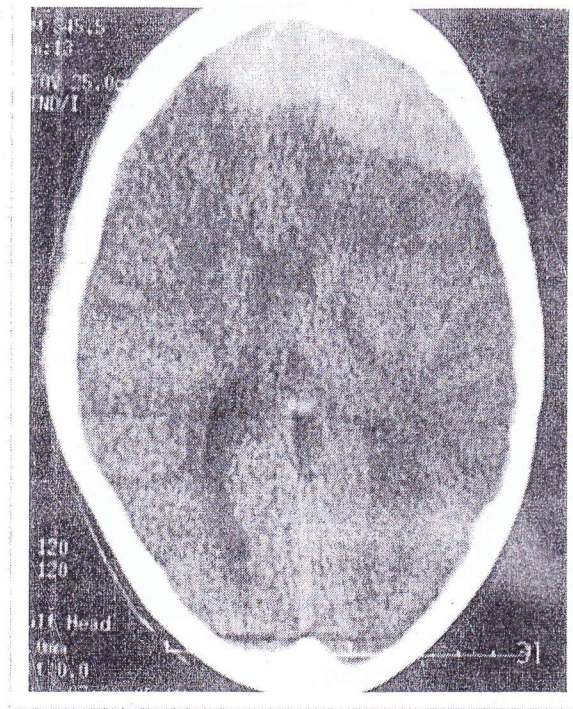
- Plain CT brain at multiple levels (Supraventricular, bodies, horns & posterior fossa)
- Midline hypodense lesion occupying most of the posterior cranial fossa, obliterating the 4th ventricle
- There is marked dilatation of the bodies & horns of the lateral ventricles
- Ballooning of the 3rd ventricle

Diagnosis: Posterior cranial fossa tumor most probably medulloblastoma with secondary hydrocephalic changes



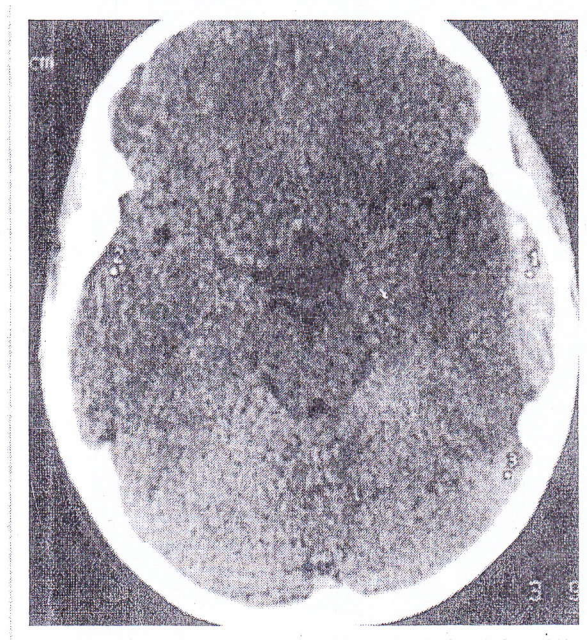
- CT brain with IV contrast at multiple levels...
- Midline hyperdense lesion (Diffuse enhancement) occupying most of the posterior cranial fossa, obliterating the 4th ventricle
- There is marked dilatation of ...

Diagnosis: Posterior cranial fossa tumor most probably medulloblastoma with secondary hydrocephalic changes



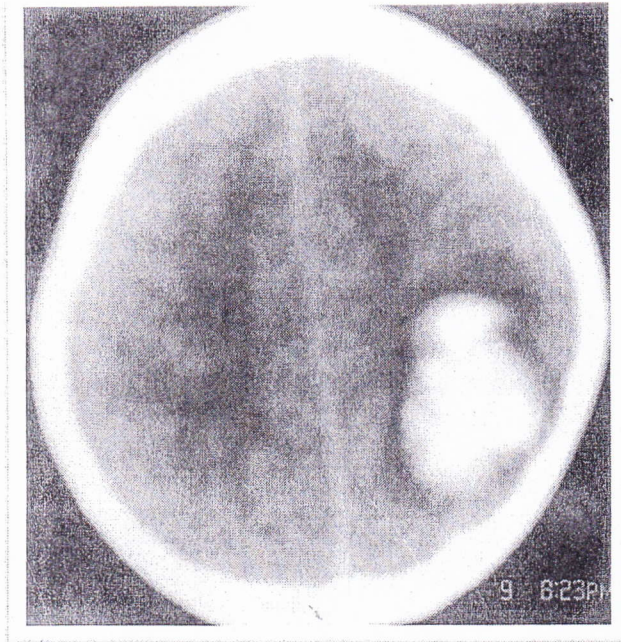
- Plain CT brain at the level of the horns of the lateral ventricles
- Bifrontal hyperdense lesion with an outer convex & inner straight borders

Diagnosis: Bifrontal subdural hematoma



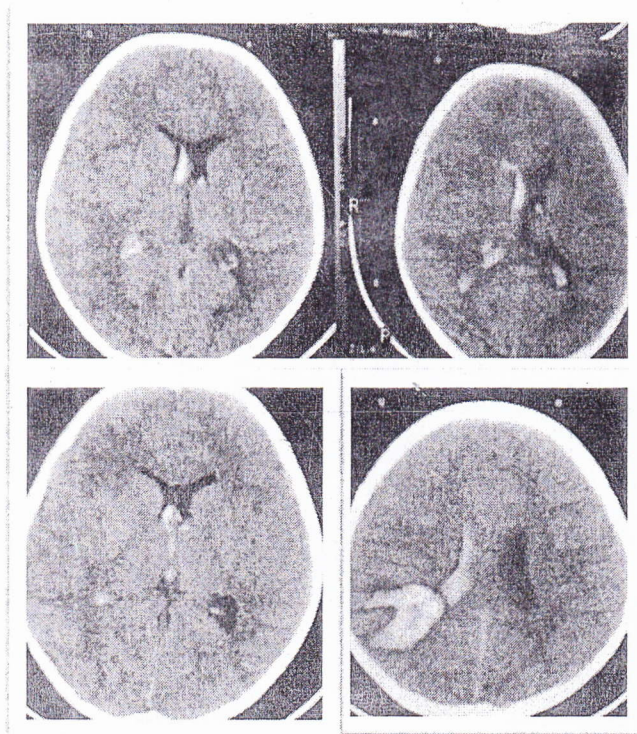
- Plain CT brain at the level of the horns of the lateral ventricles
- Left temporal hyperdense lesion with an outer convex & inner straight borders
- Left temporal extracranial hematoma (cephalhematoma)
- Loss of demarcation between gray & white matters
- Attenuated ventricular & extraventricular CSF spaces
- Generalised hypodensity

Diagnosis: Left subdural hematoma with brain edema



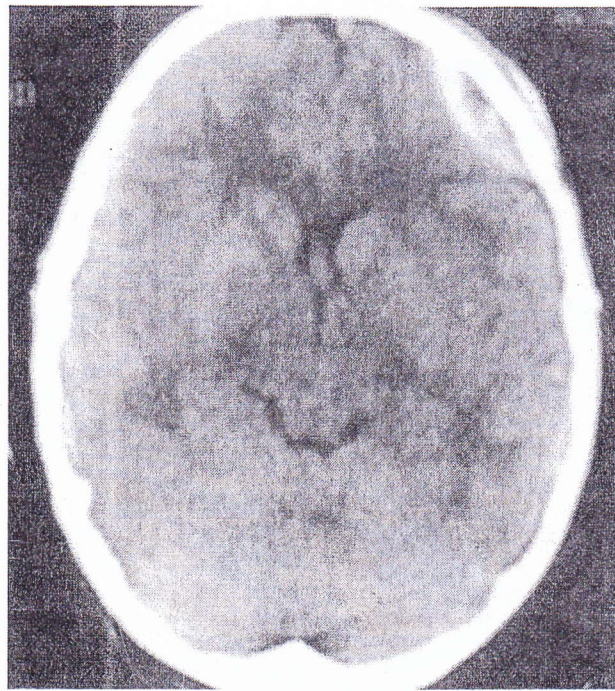
- Plain CT brain at the supraventricular level
- Hyperdense lesion in the left occipito-parietal area (IntracerebralHge), surrounded by a hypodense area (Localized brain edema)

Diagnosis: Left occipito-parietal intracerebral hematoma



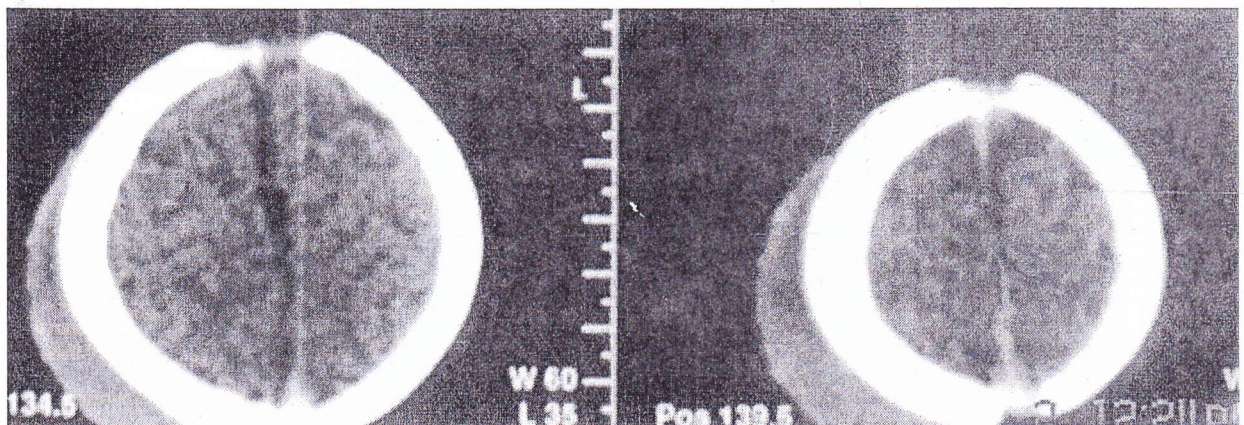
- Plain CT brain at the levels of the bodies & horns of the lateral ventricles
- Hyperdense lesion in the Rt occipital lobe (Intracerebral hematoma)
- Hyperdense lesions in the body, frontal & occipital horns of the Rt lateral ventricle
- Hyperdense lesion in the occipital horns of the Lt lateral ventricle
- Hyperdense lesion in the 3rd ventricle

Diagnosis: Rt occipital intracerebral hematoma & IntraventricularHge



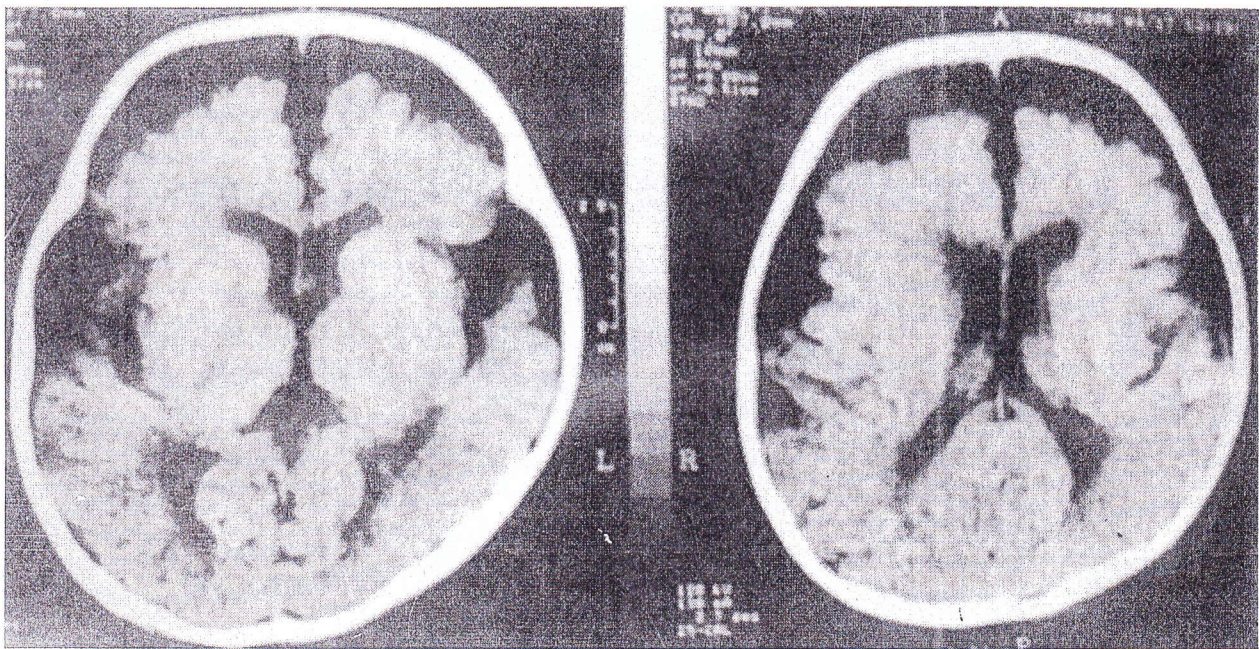
- Plain CT brain at the level of the bodies & horns of the lateral ventricles
- Left frontal biconvex hyperdense lesion
- Left frontal extracranial hematoma (cephalhematoma)

Diagnosis: Lt frontal epidural (Extradural) hematoma



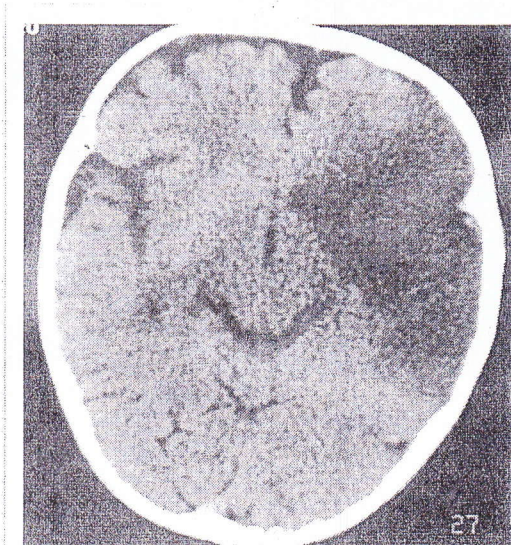
- Plain CT brain at the supraventricular level
- Bone defect = AF
- Right occipito-parietal extra-cranial hyperdense lesion (hematoma) = cephalhematoma

Diagnosis: Rt occipito-parietal cephalhematoma

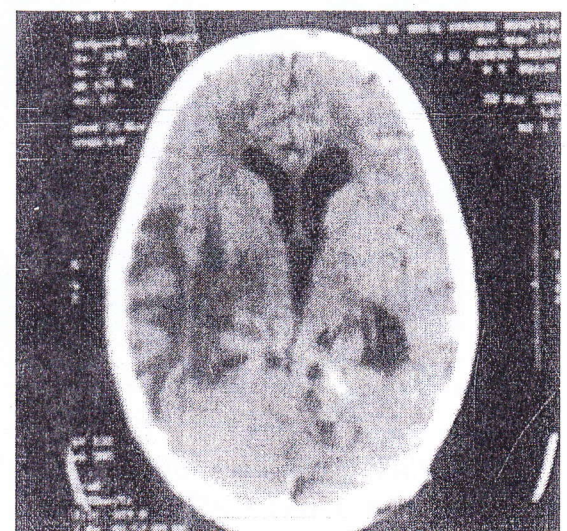


- Plain CT brain at the level of the horns of the lateral ventricles
- Loss of brain substance (More marked in the frontal lobes)
- Prominent cerebral sulci & Sylvian fissures
- Prominent ventricular CSF spaces "Passive dilatation": Horns & 3rd ventricle
- Prominent extraventricular CSF spaces (Cisterns)

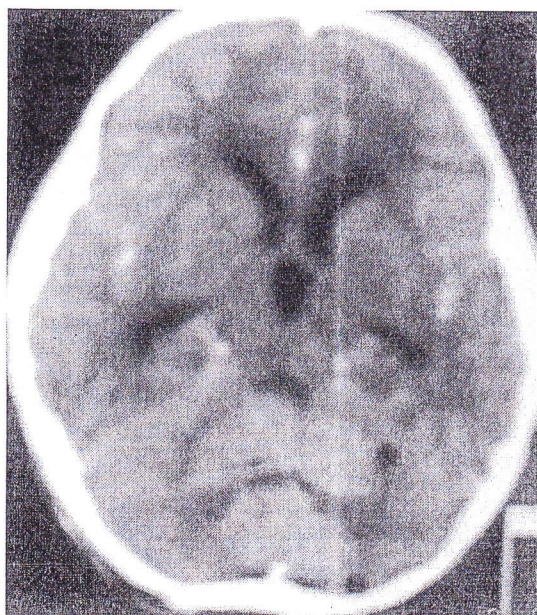
Diagnosis: Brain atrophy



- Plain CT brain at the level of the 3rd ventricle
 - Lt fronto-temporal triangular hypodense lesion
 - Mild atrophic changes in the Rt frontal lobe
- Diagnosis: Lt fronto-temporal cerebral infarction**

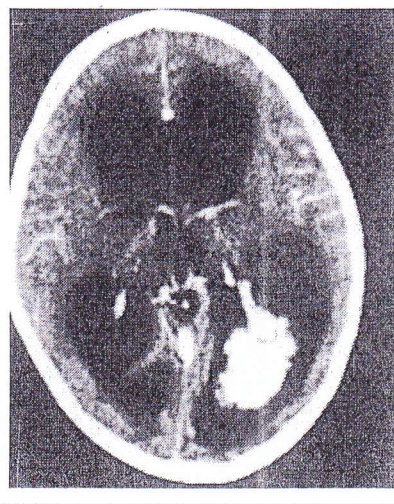
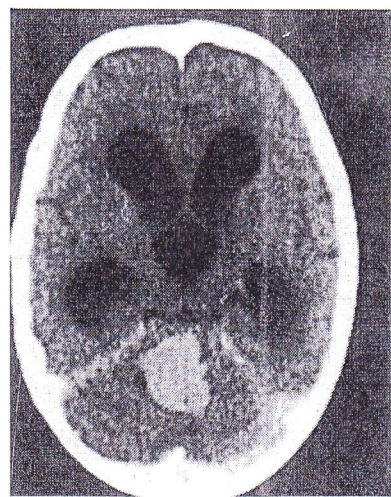


- Plain CT brain at the level of the 3rd ventricle
 - Localized hypodense area in the Rt parietal lobe
- Diagnosis: Rt parietal cerebral infarction**



- CT brain with IV contrast at the level of post. fossa
- Midline hyperdense lesion (Diffuse enhancement) occupying most of the posterior cranial fossa, obliterating the 4th ventricle
- Dilatation of ...

Diagnosis: Posterior cranial fossa tumor most probably medulloblastoma with secondary hydrocephalic changes



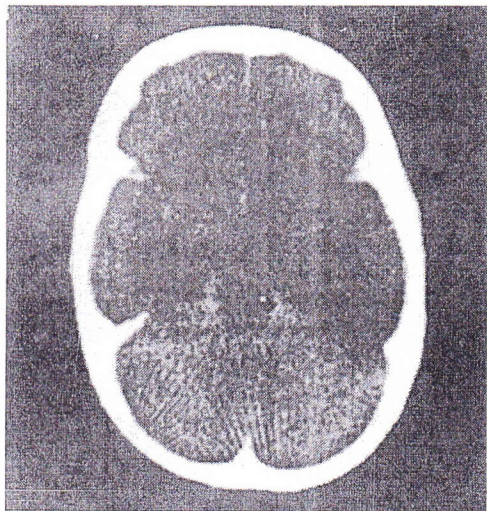
- CT brain with IV contrast at the level of 3rd ventricle
- Hyperdense lesion (Diffuse enhancement) is seen in the Lt occipital horn
- Mass is attached to the ventricular wall through a pedicle
- Dilatation of the 3rd ventricle & horns of lateral ventricles

Diagnosis: Chroid plexus papilloma



- CT brain with IV contrast at the level of post. fossa
- Lt cerebellar hemisphere cystic mass with irregular ring enhancement

Diagnosis: Posterior cranial fossa tumor most probably astrocytoma



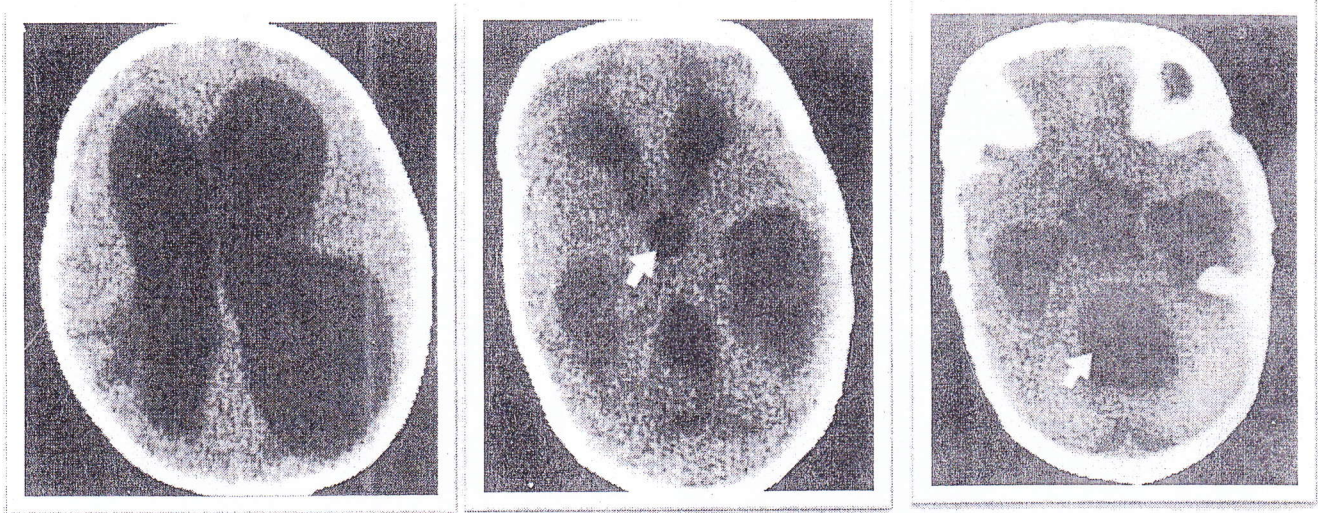
- Plain CT brain at the level of the post. fossa
- Generalized hypodensity
- Loss of demarcation between gray & white matters
- Attenuated ventricular & extraventricular CSF spaces

Diagnosis: Brain edema

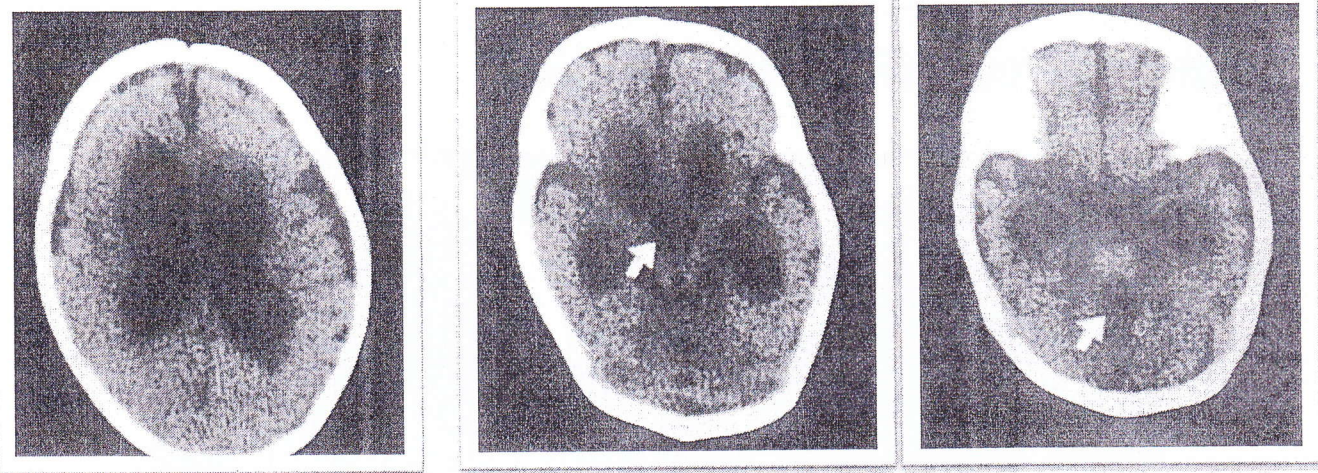


- Plain CT brain at the level of the bodies of lateral ventricles
- Bilateral symmetric periventricular hyperdense areas
- ?Congenital infection most probably CMV

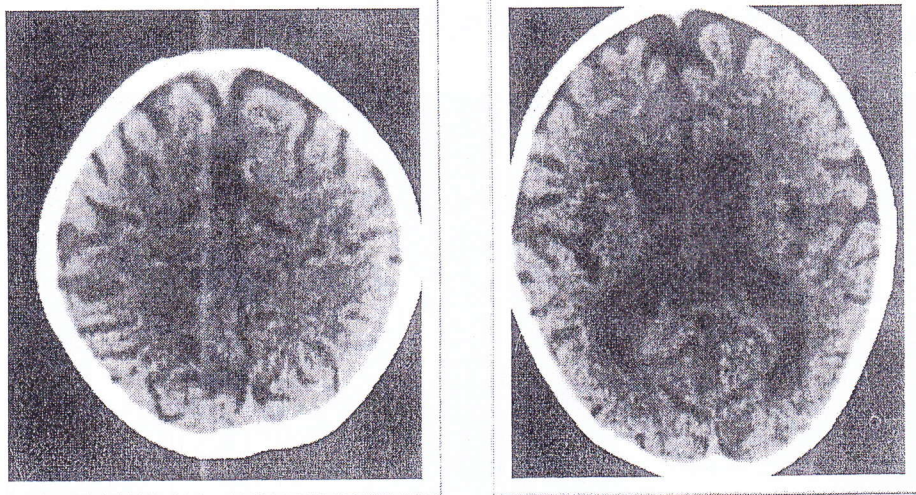
Diagnosis: Periventricular calcification



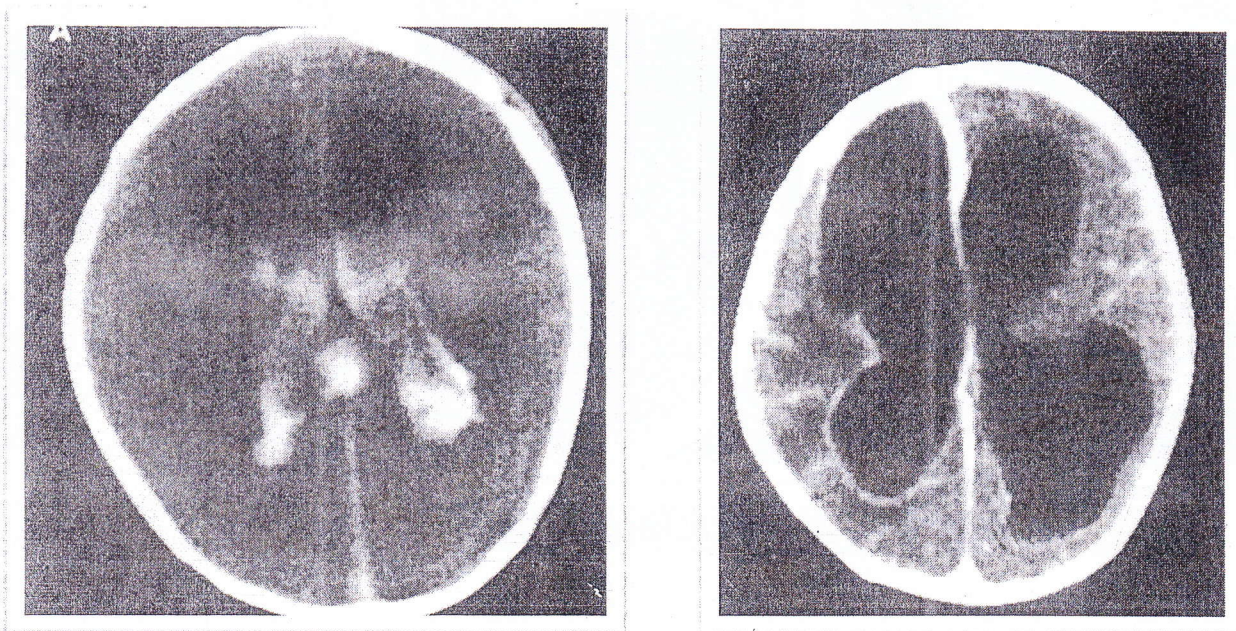
Communicating Hydrocephalus



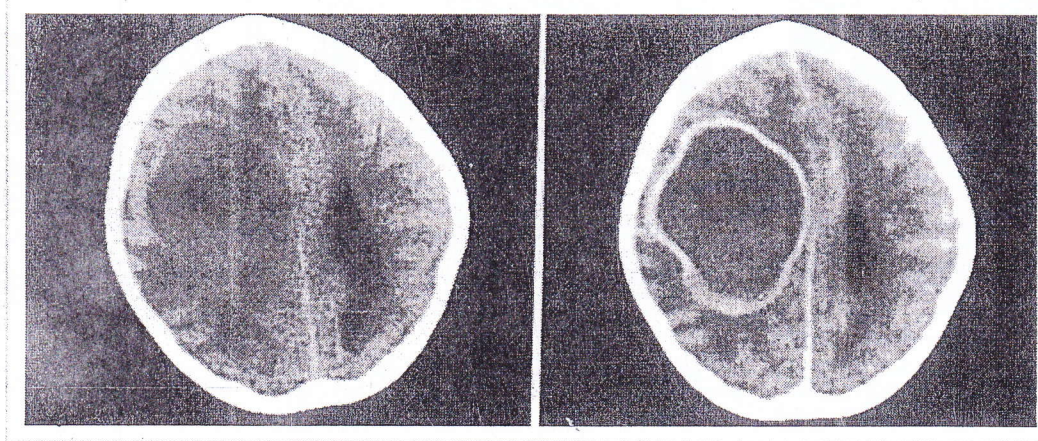
Obstructive Hydrocephalus



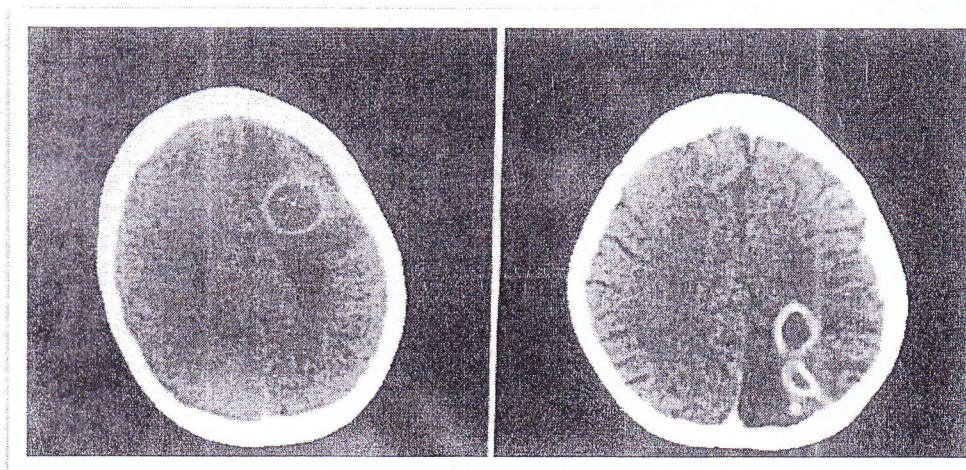
Brain Atrophy



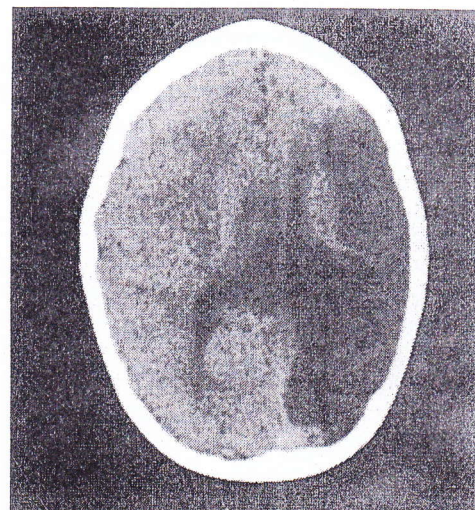
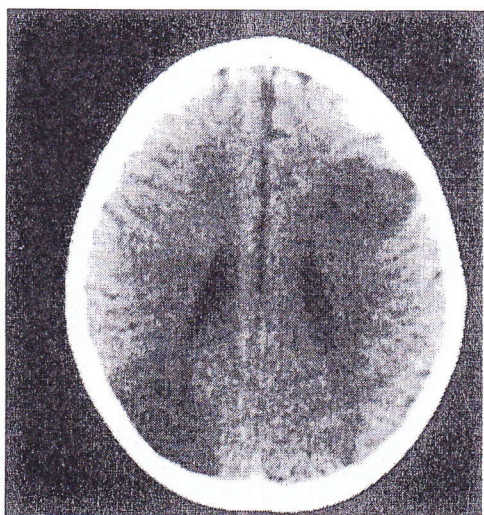
Intraventricular hemorrhage
Ventriculitis



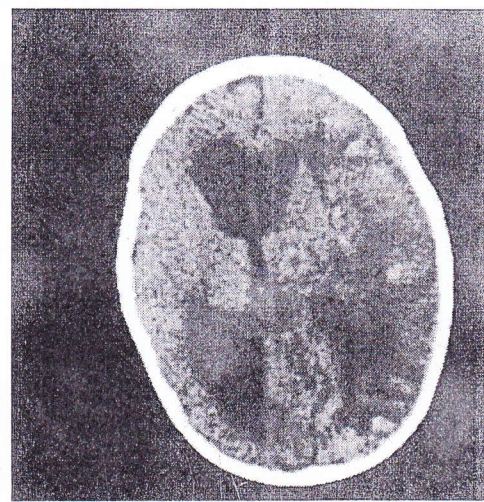
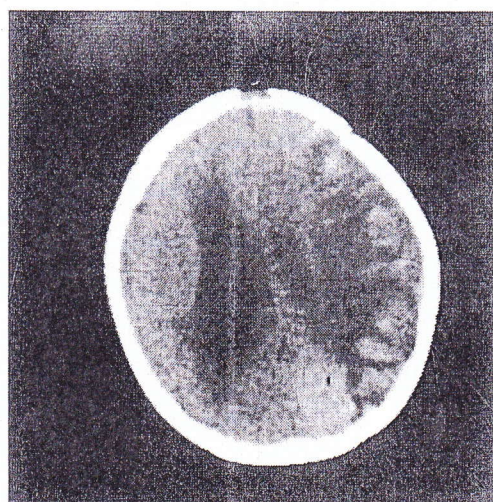
Brain Abscess (Before & after IV contrast)



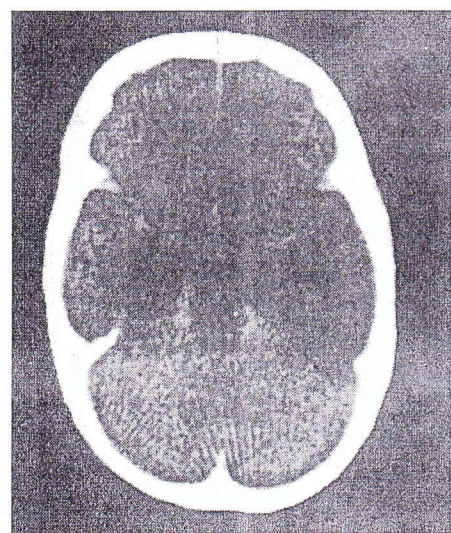
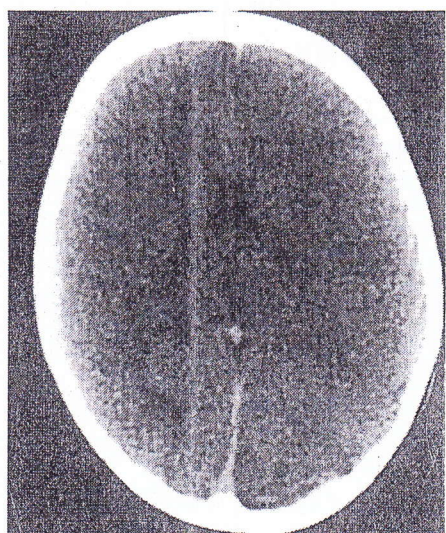
Brain Abscess (IV contrast)



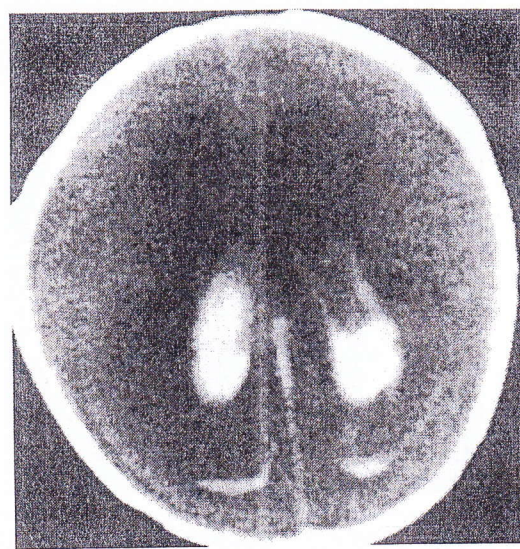
Cerebral Infarction



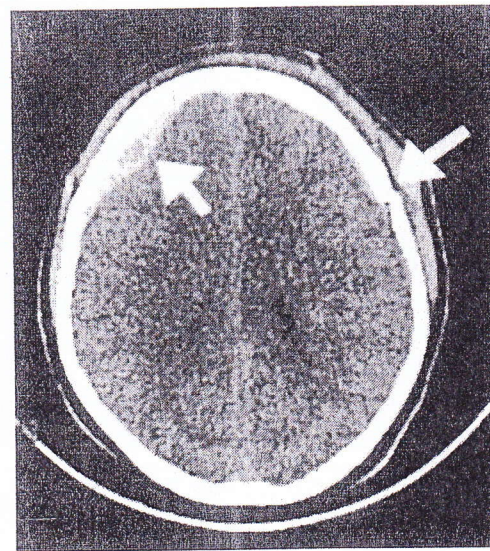
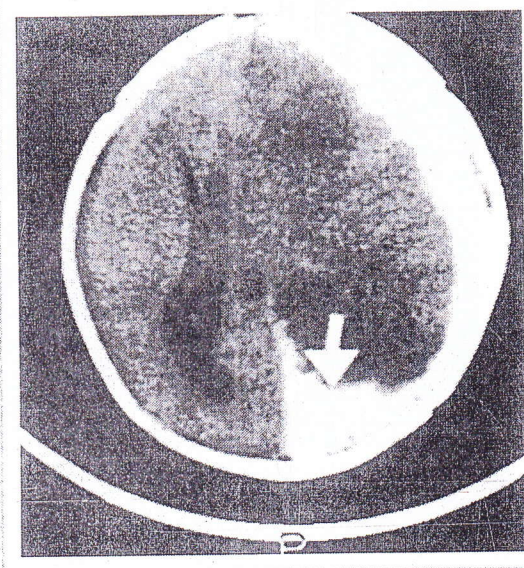
Cerebral Hemorrhagic Infarction



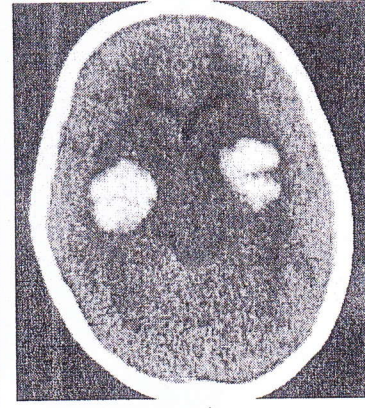
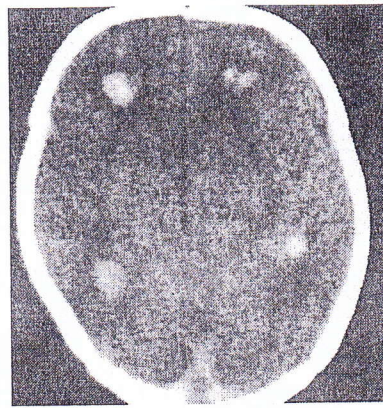
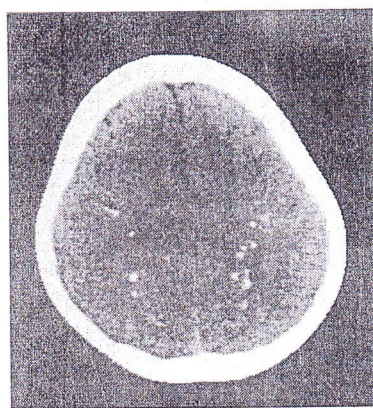
Brain Edema



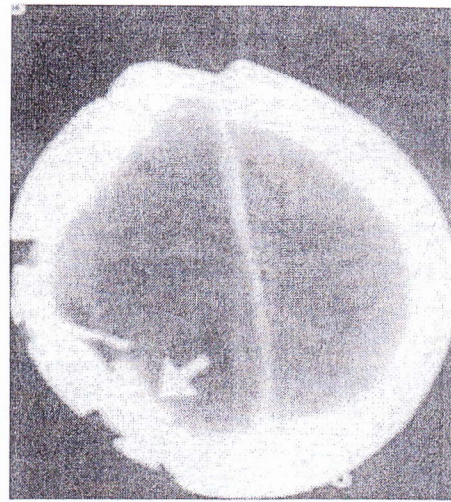
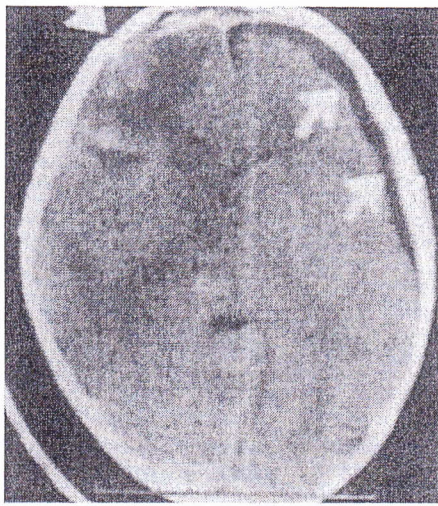
Intracerebral hematoma Intraventricular hemorrhage



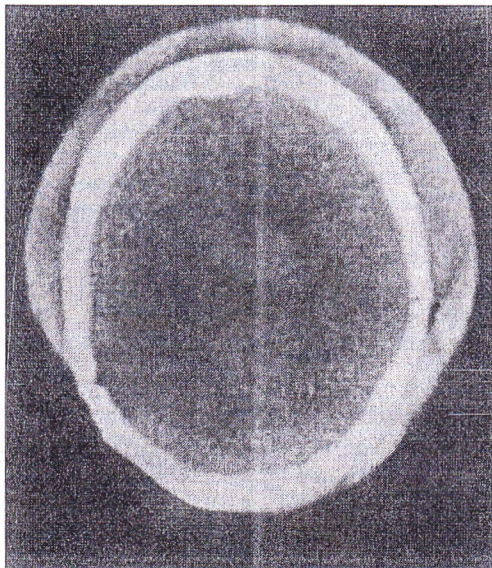
Subdural hematoma Extradural hematoma



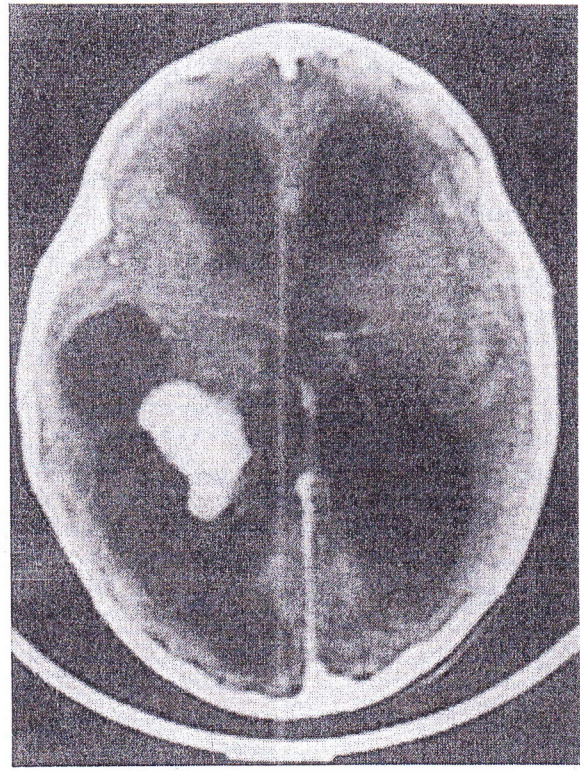
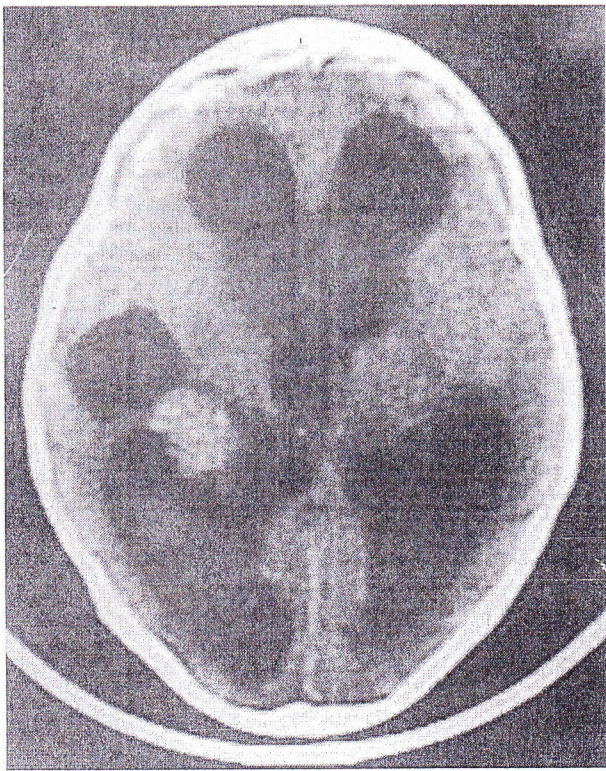
Scattered Periventricular BG calcification



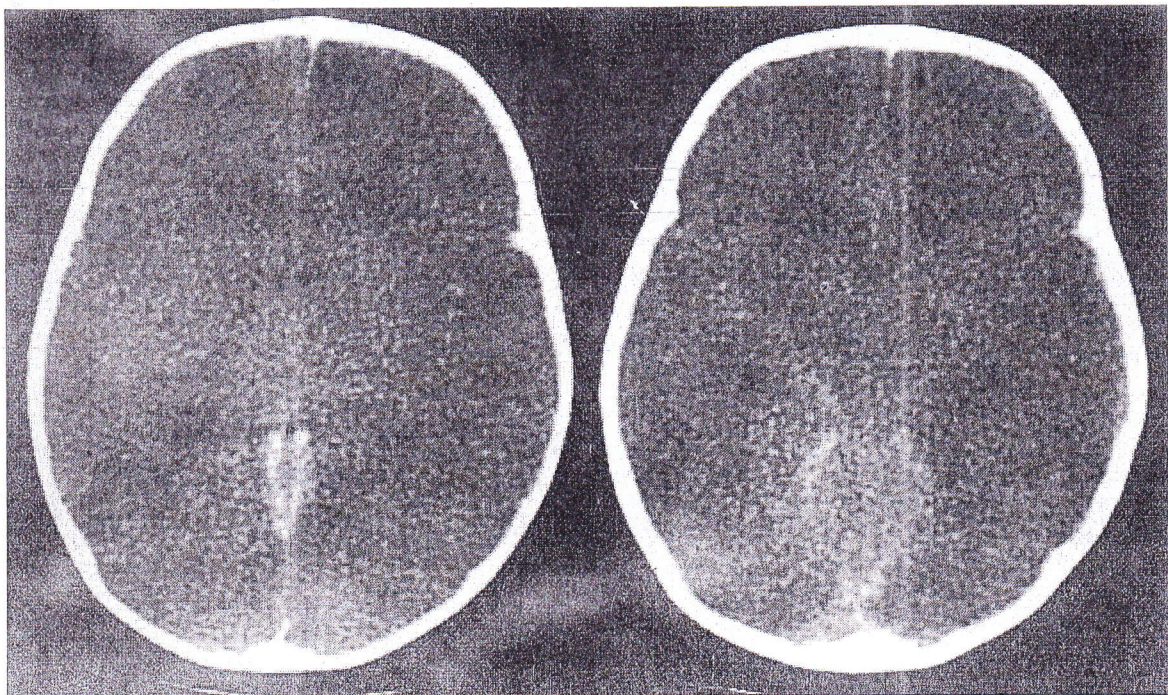
Linear fracture
Depressed fracture
& Subdural effusion



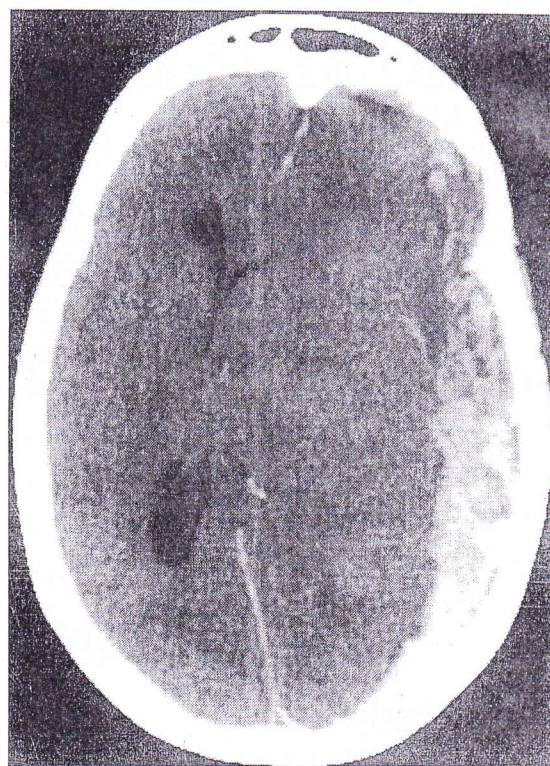
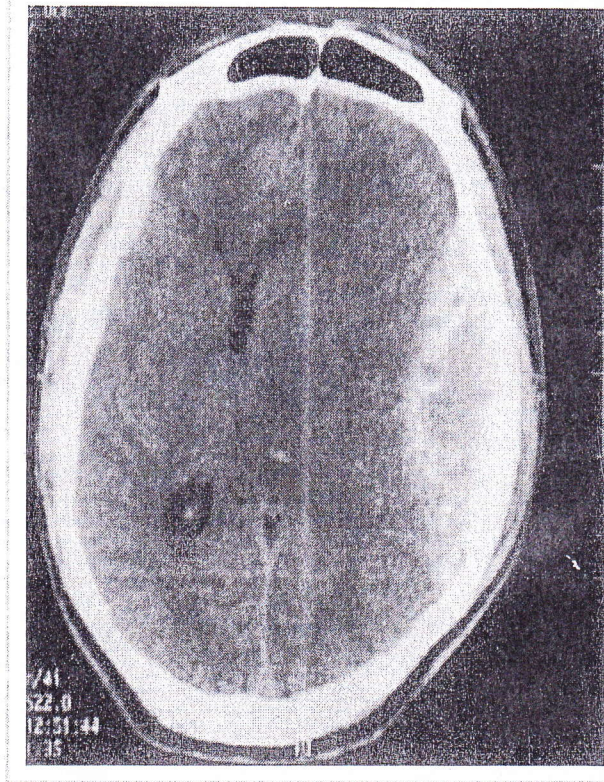
Bilateral cephalhematoma
Fracture + Hematoma +
Depressed fracture
Cephalhematoma



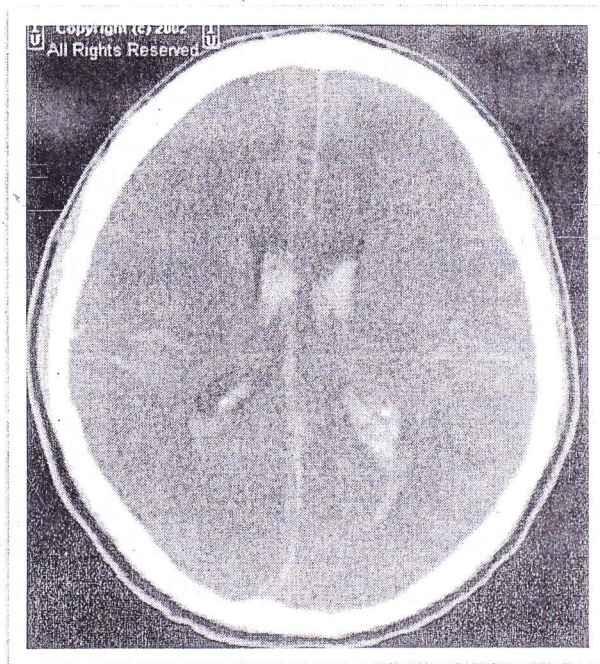
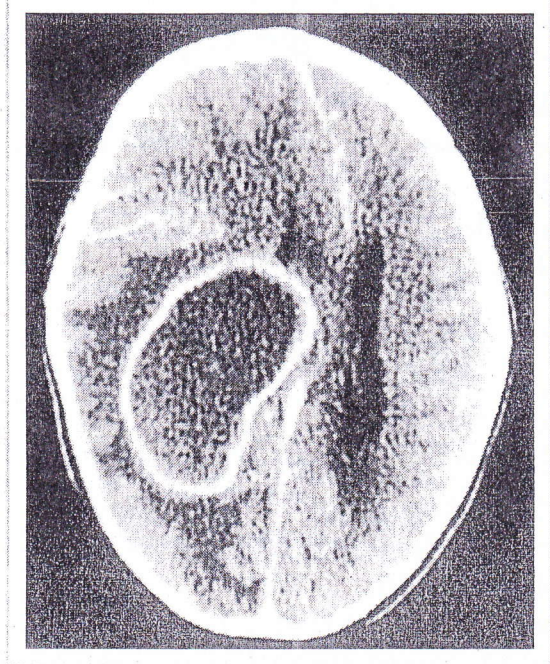
Chroid plexus papilloma (Before & After IV contrast)



Brain Edema



Extradural hematoma Subdural hematoma



Rt parietal brain abscess Intraventricular & Subarachnoid hemorrhage

Blood Gases Report

A) Main Acid & Main Alkali

- Main acid: CO_2
- Main alkali: HCO_3

B) Main Organs controlling AB balance

- Lungs: Through control of PaCO_2
- Kidneys: Through control of HCO_3

C) Items in ABG

- pH
- PaO_2
- PaCO_2
- HCO_3

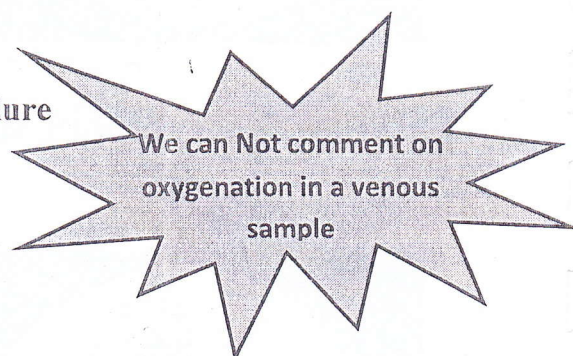
Item	Normal Value
pH	7.35-7.45
PaO_2	80-100 mmHg
PaCO_2	35-45 mmHg
HCO_3	20-24 mEq/dL

Interpretation of Blood Gases

3

A) Oxygenation

- PaO_2 80-100 mmHg = Normal Oxygenation
- $\text{PaO}_2 < 70$ mmHg = Hypoxemia
- $\text{PaO}_2 < 50$ mmHg = Hypoxemic respiratory failure
- $\text{PaO}_2 > 100$ mmHg = Hyperoxygenation
 - Oxygen therapy
 - Air in the sample



B) Ventilation

- PaCO_2 35-45 mmHg = Normal Ventilation
- $\text{PaCO}_2 < 35$ mmHg = Hyperventilation (either compensatory or Mechanical Vent.)
- PaCO_2 45-50 mmHg = Mild Hypoventilation
- PaCO_2 50-60 mmHg = Moderate Hypoventilation
- $\text{PaCO}_2 > 60$ mmHg = Severe Hypoventilation

C) Acid-Base Balance

c. pH < 7.35: Acidosis

- $\downarrow\downarrow \text{HCO}_3 + \downarrow\downarrow \text{PaCO}_2$: Metabolic acidosis*
- $\uparrow\uparrow \text{PaCO}_2 + \uparrow\uparrow \text{HCO}_3$: Respiratory acidosis*
- $\uparrow\uparrow \text{PaCO}_2 + \text{Normal HCO}_3$: Respiratory acidosis*
- $\downarrow\downarrow \text{HCO}_3 + \text{Normal PaCO}_2$: Mixed metabolic & respiratory acidosis
- $\downarrow\downarrow \text{HCO}_3 + \uparrow\uparrow \text{PaCO}_2$: Mixed metabolic & respiratory acidosis
- $\downarrow\downarrow \text{HCO}_3 + \text{Near normal PaCO}_2$: Mixed metabolic & respiratory acidosis
- Very low pH + Near normal HCO_3 & PaCO_2 : Mixed metabolic & resp. acidosis*
- Very low pH + Normal HCO_3 & PaCO_2 : Mixed metabolic & resp. acidosis*

d. pH > 7.45: Alkalosis

- $\downarrow\downarrow \text{PaCO}_2 \pm \downarrow\downarrow \text{HCO}_3$: Respiratory alkalosis
- $\uparrow\uparrow \text{HCO}_3 \pm \uparrow\uparrow \text{PaCO}_2$: Metabolic alkalosis

Item	Value
pH	7.12
PaO ₂	95 mmHg
PaCO ₂	22 mmHg
HCO ₃	9 mEq/dL

Item	Value
pH	7.1
PaO ₂	50
PaCO ₂	40
HCO ₃	18

Item	Value
pH	7.05
PaO ₂	95
PaCO ₂	22
HCO ₃	9

Item	Value
pH	7.23
PaO ₂	40
PaCO ₂	65
HCO ₃	30

Item	Value
pH	7.18
PaO ₂	45
PaCO ₂	75
HCO ₃	24

Item	Value
pH	7.55
PaO ₂	97
PaCO ₂	25
HCO ₃	16

Item	Value
pH	7.55
PaO ₂	97
PaCO ₂	27
HCO ₃	21

Item	Value
pH	7.1
PaO ₂	60
PaCO ₂	20
HCO ₃	9

Item	Value
pH	7.05
PaO ₂	55
PaCO ₂	33
HCO ₃	19

Item	Value
pH	7.12
PaO ₂	60
PaCO ₂	31
HCO ₃	18

Item	Value
pH	7.54
PaO ₂	94
PaCO ₂	40
HCO ₃	36

Item	Value
pH	7.18
PaO ₂	98
PaCO ₂	17
HCO ₃	7

Causes of Metabolic Acidosis**A. Loss of HCO_3**

1. GIT: Diarrhea
2. Renal: Renal failure, Renal tubular acidosis

B. Addition of acids

1. Shock
2. Diabetic ketoacidosis
3. Poisoning: Salicylates
4. Type 1 respiratory failure (Hypoxemic respiratory failure)

Causes of Respiratory Acidosis

1. Type 2 respiratory failure (Hypercapnic respiratory failure)
2. Chest diseases: Pneumonia...

Causes of Metabolic Alkalosis

1. Vomiting: All causes including CHPS
2. Excess HCO_3 administration

Causes of Respiratory Alkalosis

1. Early pneumonia
2. Encephalitis
3. Head trauma
4. Hysterical
5. Fever
6. Pain & anxiety

Arterial sample

Item	Value
pH	7.2
PaO ₂	93
PaCO ₂	28
HCO ₃	12

1. This patient has metabolic acidosis
2. Bicarbonate is within normal
3. This patient has hyperventilation
4. This patient has mixed (metabolic and respiratory) acidosis
5. PaCO₂ is normal
6. DKA may be the cause
7. Shock may be the cause
8. Poisoning with salicylates may be the etiology
9. HCO₃ therapy may be of value
10. Respiratory rate is increased
11. The main pathology is in the lungs
12. Oxygen therapy is highly beneficial

Arterial sample

Item	Value
pH	7.17
PaO ₂	48
PaCO ₂	62
HCO ₃	28

1. It is a case of respiratory acidosis
2. The patient is in respiratory failure
3. Bicarbonate is within normal
4. This patient has hyperventilation
5. This patient has mixed (metabolic and respiratory) acidosis
6. PaCO₂ is very low
7. Mechanical ventilation is helpful
8. Bicarbonate therapy is urgently needed

Venous sample

Item	Value
pH	7.55
PaO ₂	50
PaCO ₂	47
HCO ₃	32

1. It is a case of respiratory alkalosis
2. Serum bicarbonate is elevated
3. The patient is in a state of hyperventilation
4. This patient has metabolic acidosis
5. Pneumonia may be the cause
6. Fever may the cause

Venous sample

Item	Value
pH	7.55
PaO ₂	44
PaCO ₂	25
HCO ₃	21

1. This patient has severe hypoxemia
2. This patient has metabolic alkalosis
3. His respiratory rate is expected to be rapid
4. It is a case of respiratory alkalosis
5. Serum bicarbonate is elevated
6. The patient is in a state of hypoventilation
7. Early pneumonia may be the cause
8. Fever or encephalitis may the cause

Arterial sample

Item	Value
pH	7.1
PaO ₂	50
PaCO ₂	40
HCO ₃	18

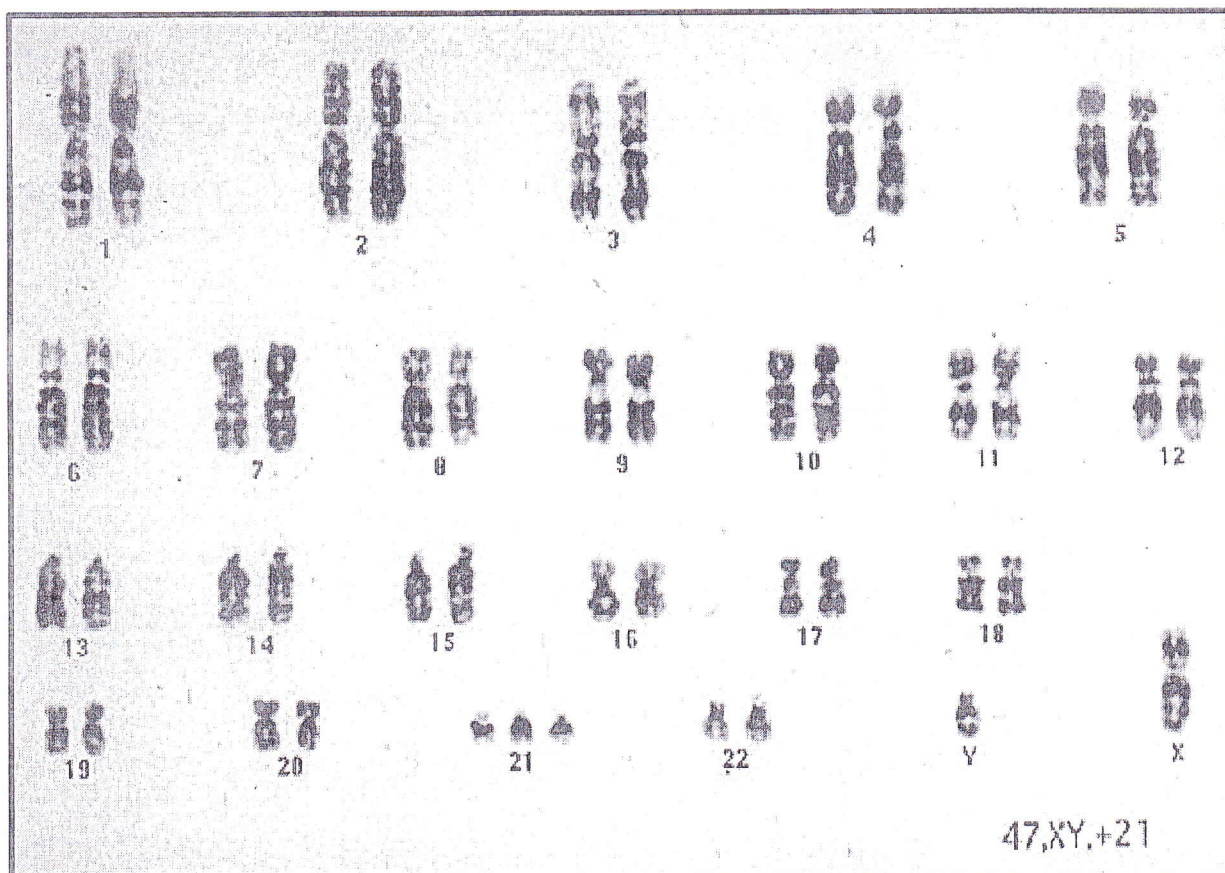
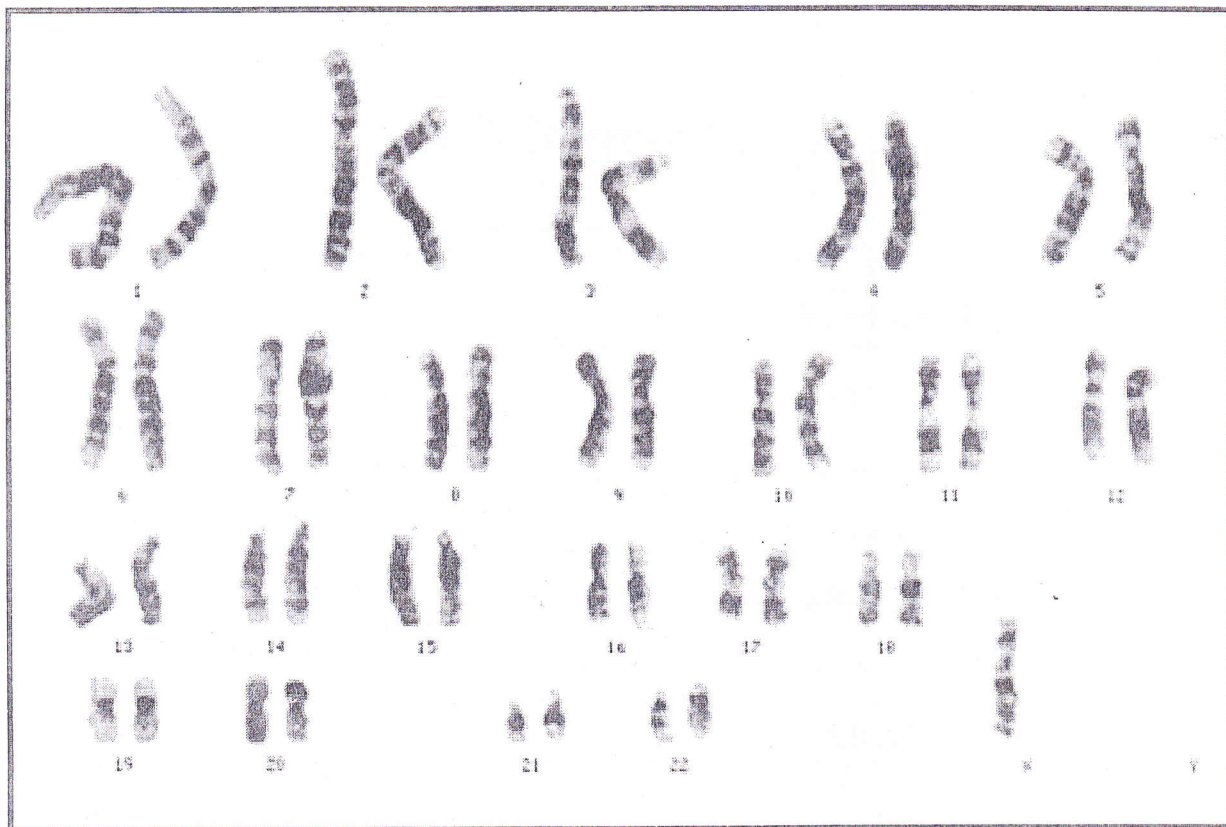
1. This patient has metabolic acidosis
2. Bicarbonate is near normal
3. This patient has normal ventilation
1. This patient has pure metabolic acidosis
2. This patient has mixed (metabolic and respiratory) acidosis
3. PaCO₂ is low
4. Hysterical hyperventilation may be the cause
5. pH is very low
6. This patient has severe hypoxemia
7. Oxygenation is impaired
8. Oxygenation can be properly assessed by such blood gases

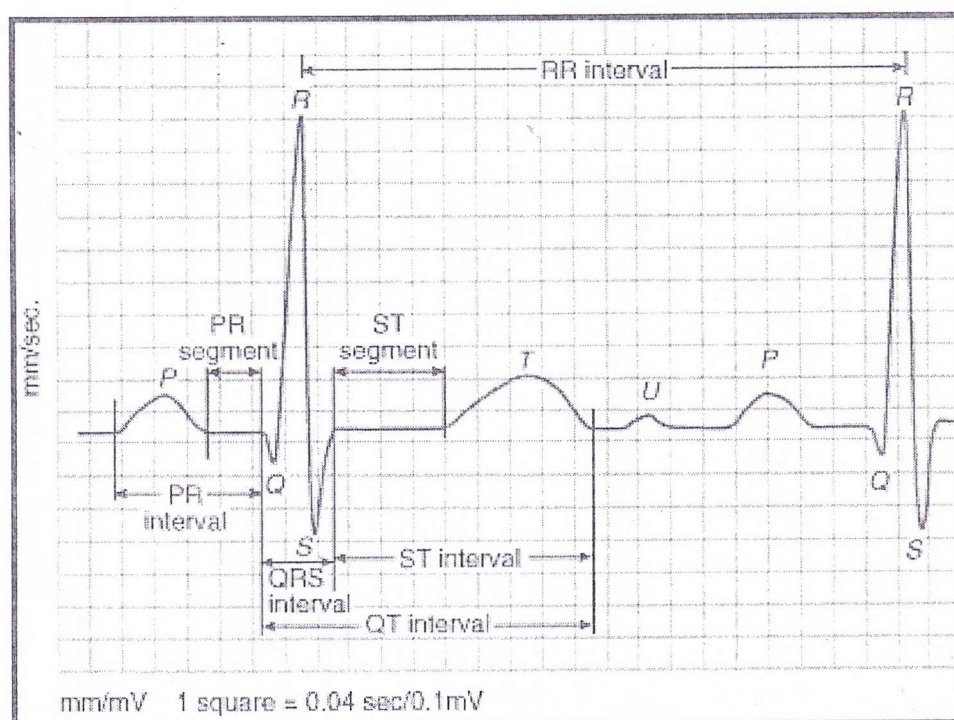
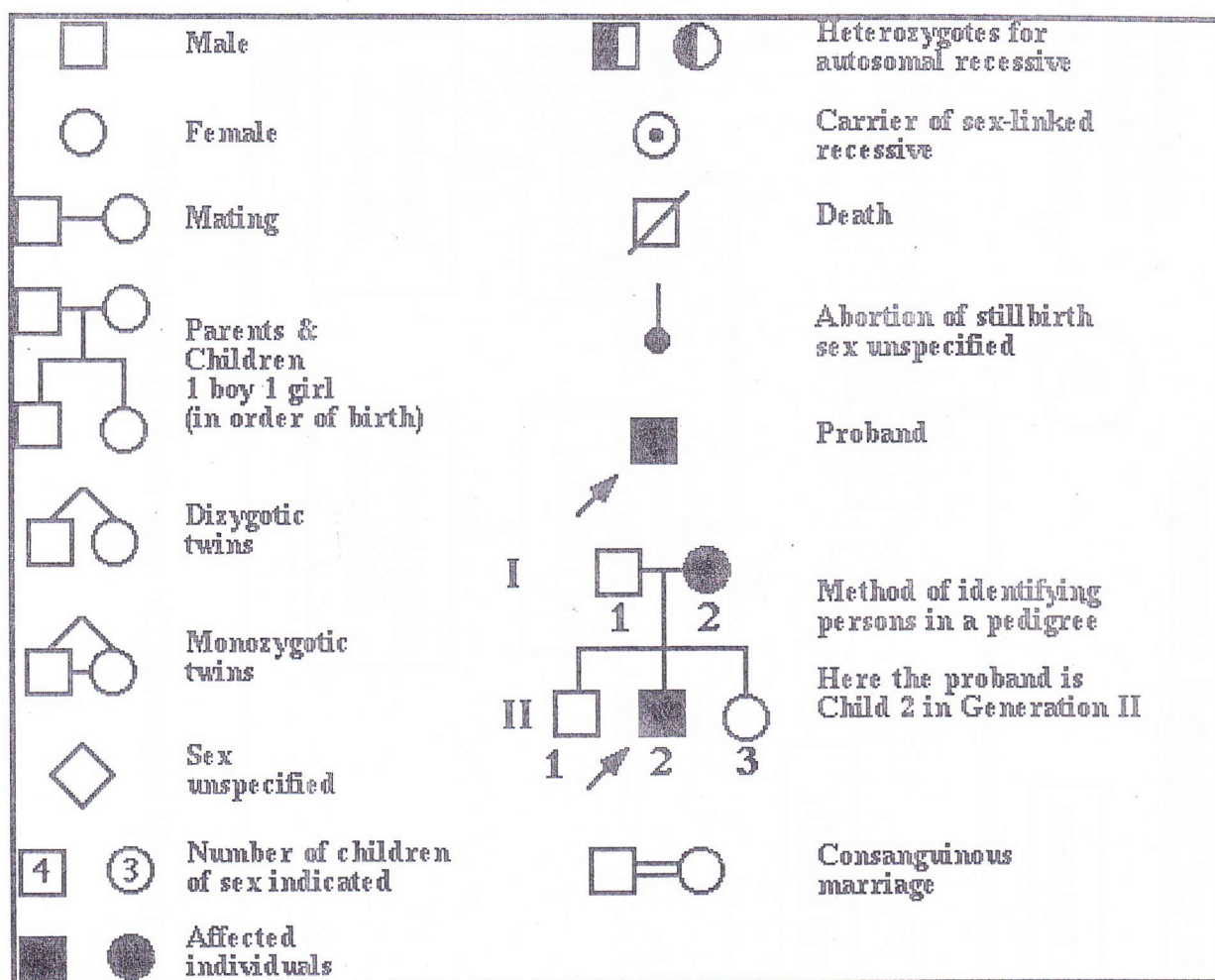
Normal CSF

	Normal
Physical	
Aspect	Clear
Tension	50-80 mmH ₂ O
Chemical	
Proteins (mg/dL)	20-40
Glucose (mg%)	[2/3 blood glucose] 40-80
Cells	
Type	Lymphocytes (75-100%)
Number (μ L or mm ³)	0-5

Abnormal CSF

	Bacterial	Viral	TB	Partially-treated
Physical				
Aspect	Turbid	Clear	Yellow opalescent	Clear
Tension	↑↑	May ↑↑	↑↑	Normal or ↑↑
Chemical				
Proteins	↑↑ 100-500	Normal or ↑↑ (50-200)	Marked ↑↑ (100-3000)	↑↑ 100-200
Glucose	↓↓ (< 2/3 BG)	Normal or ↓↓	Very ↓↓	Normal or ↓↓
Cells				
Type	Mainly PNLs	Mainly Lymphocytes	(Early PNL then...)	Mixed or Lymphocytes
Number (μ L or mm ³)	100-10.000 (or more)	Up to 1.000	Up to 1.000	5-10.000

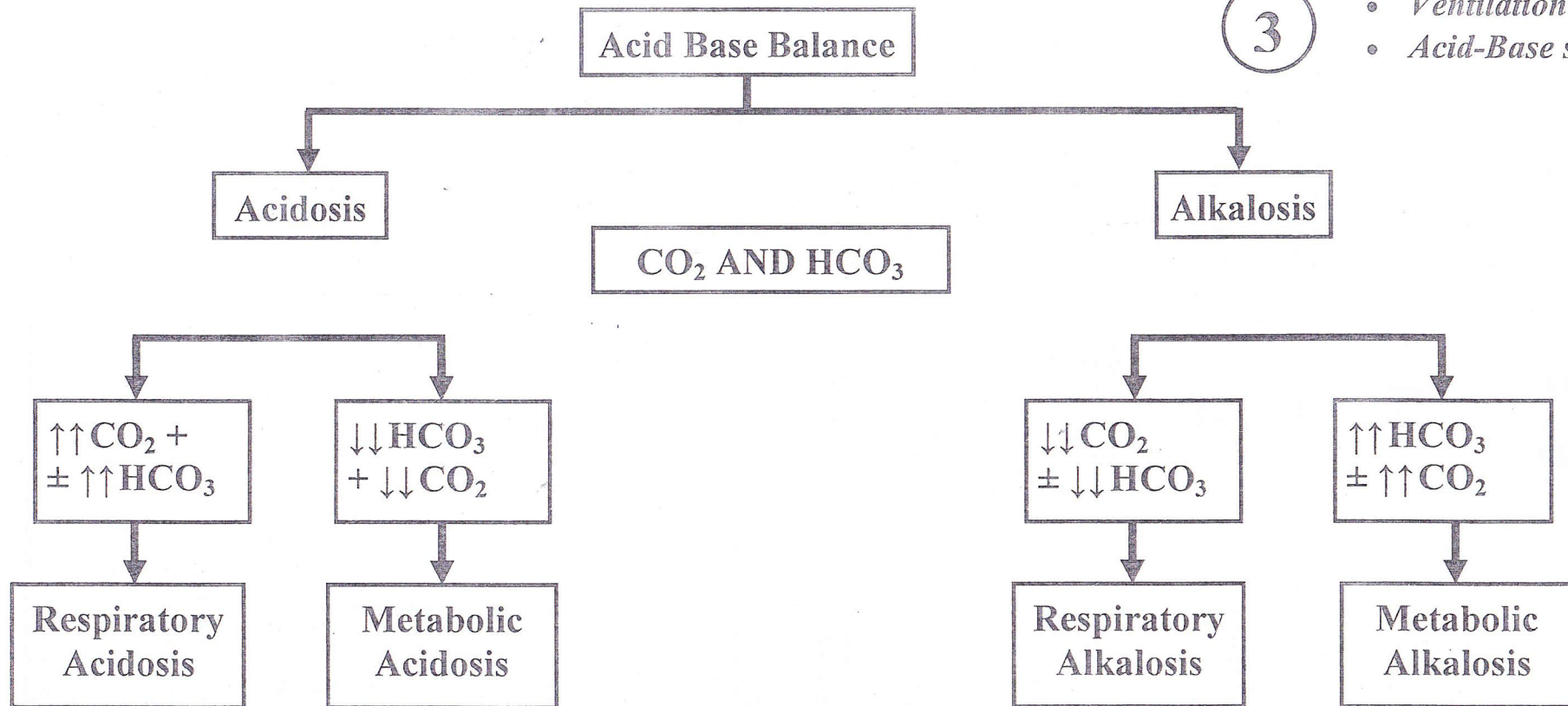




Interpretation of Blood Gases

- Oxygenation
- Ventilation
- Acid-Base status

3



Remember

- Mixed metabolic & respiratory acidosis: Very low pH + Normal (Or near normal) HCO₃ & PaCO₂
- Near normal HCO₃ ≈ 17-20 mEq/L
- Near normal CO₂ ≈ 30-35 mmHg
- There is No mixed alkalosis